

Z. CONFERTA, Walk. Cat. Lep. Het. B. M. vii. p. 1536.

Silhet.

Z. PAUCIPUNCTATA, Walk. ib. vii. p. 1537.

Silhet.

Fam. HEPIALIDÆ.

HEPIALUS NIPALENSIS, Steph., Walk. ib. vii. p. 1557.

PHASSUS DAMOR, Moore, Cat. Lep. E. I. C. ii. p. 437.

P. ABOE, Moore, ib. ii. p. 437.

DESCRIPTION OF PLATES XXXII. & XXXIII.

PLATE XXXII.

- | | |
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| Fig. 1. <i>Cimicodes castanearia</i> , p. 616. | Fig. 6. <i>Vindusara compositata</i> (♂), p. 653. |
| 2. <i>Agnidra specularia</i> , p. 618. | 7. <i>Homerothrips retractaria</i> , p. 627. |
| 3. <i>Garæus specularis</i> , p. 623. | 8. <i>Bargosa fasciata</i> , p. 634. |
| 4. <i>Dalima apicata</i> , p. 615. | 9. <i>Selenia decorata</i> (♀), p. 621. |
| 5. <i>Xandrames albofasciata</i> , p. 635. | 10. <i>Corotia cervinaria</i> , p. 625. |

PLATE XXXIII.

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|---|---|
| Fig. 1. <i>Psyra similaria</i> , p. 659. | Fig. 11. <i>Caprilia specularia</i> , p. 649. |
| 2. <i>Arichanna trancsata</i> , p. 658. | 12. <i>Acidalia bicaudata</i> , p. 643. |
| 3. — <i>marmorata</i> , p. 659. | 13. <i>Brihaspa atrostigmella</i> , p. 666. |
| 4. <i>Cleora decussata</i> , p. 628. | 14. <i>Tyana callichlora</i> , p. 668. |
| 5. <i>Cidaria argenti-lineata</i> , p. 660. | 15. — <i>superba</i> , p. 668. |
| 6. — <i>calamistrata</i> , p. 663. | 16. <i>Ranila marginella</i> , p. 667. |
| 7. — <i>obscurata</i> , p. 663. | 17. <i>Propackys linealis</i> , p. 665. |
| 8. — <i>aurantiaria</i> , p. 661. | 18. <i>Hyponomeuta lineatorotella</i> , p. 669. |
| 9. <i>Melanippe catenaria</i> (♀), p. 655. | |
| 10. <i>Sauris decussata</i> , p. 655. | |

June 27, 1867.

Dr. E. Hamilton, V.P.Z.S., in the Chair.

Dr. J. Murie read a memoir on the anatomy of the Pilot Whale (*Globiocephalus melas*). Dr. Murie's observations on this animal were based upon a specimen recently captured off the coast of Scotland.

This paper will be printed entire in the Society's 'Transactions.'

Mr. P. L. Sclater, Secretary to the Society, called attention to the following noticeable additions to the Society's Menagerie since the last Meeting, all of the species being novelties to the collection:—

1. Two Eyton's Tree-ducks (*Dendrocygna eytoni*), presented by

the Acclimatization Society of Sydney, New South Wales, being the specimens referred to by Dr. Bennett in his letters (P. Z. S. 1866, pp. 149, 417): received May 11th.

2. Two young Night-herons in immature plumage, purchased May 14th, being apparently the young of *Nycticorax cucullatus* (Wagl.) of Western Africa.

3. Two Yellow-rumped Parrakeets (*Platycercus flaveolus*, Gould) from Australia, purchased May 27th.

4. A young Kite, supposed to be the young of the Square-tailed Kite (*Milvus isurus*, Gould) from Australia, purchased May 27th.

5. Three Mauge's Ground-doves (*Geopelia maugei*, Temm., Bp. Consp. ii. p. 94), purchased June 4th, said to have been received from Australia, but more probably from Timor.

6. Two Brazilian Tree-ducks (*Dendrocygna fulva*, Gm.) from Brazil, received June 6th.

7. A male Rosy-billed Duck (*Anas peposaca*, Vieill.) from South America, received June 6th.

8. An Arabian Bustard (*Otis arabs*, Rüpp.) from West Africa, received June 6th.

9. A Senegal Bustard (*Otis senegalensis*, Vieill.) from West Africa, received June 6th.

Mr. P. L. Selater exhibited a specimen in spirits of a rare Snake (*Siphlopis fitzingeri*, Tsch. F. P. Rept. p. 57, t. 8), which had been transmitted alive to the Society by Prof. Nation, C.M.Z.S., of Lima, but had unfortunately died before reaching England. Prof. Nation stated the habitat of this species to be the coast of Peru, from the sea-level to about 700 feet elevation. As there was no example of this Snake in the National Collection, Mr. Selater proposed to present this specimen to the Trustees in the name of Prof. Nation.

Mr. P. L. Selater exhibited on behalf of Lord Lilford, F.Z.S., a nest and four eggs of the Nutcracker (*Nucifraga caryocatactes*), taken in the Hochanger Alp, in the north of Styria, in a pine-forest about 3500 feet elevation, and forwarded to Lord Lilford by Mr. E. Seidensacher of Cilli.

Mr. A. D. Bartlett made some remarks on the breeding of the Rufous Tinamou (*Rhynchotis rufescens*) in the Society's Aviaries, which had taken place for the first time this year.

Mr. Bartlett believed this to be the first instance recorded of any species of this genus breeding in captivity: the interesting fact of the male bird performing the office of incubation was supposed to be likewise hitherto unrecorded.

A more detailed account of the number of eggs laid, period of incubation, and particulars of other birds which have bred in the Society's Gardens during the present year was promised at a later Meeting.

The following papers were read:—

1. Notes on the Habits of the Lyre-bird in Captivity.

By A. D. BARTLETT, Superintendent of the Society's Gardens.

On the 9th of April last, the Society acquired a fine example of the Lyre-bird (*Menura superba*). It was a young bird, having been reared from the nest, and was consequently in immature plumage; we therefore were unable to determine its sex. This bird, considering its size, is perhaps the most active and quickest-moving bird known; its large and powerful legs and feet enable it to run with amazing swiftness; it also jumps or hops not only with great rapidity, but to almost incredible distances. These facts have been repeatedly stated by persons who have seen the bird in its native haunts; and its shy and wary habits have been frequently described.

Notwithstanding the well-known wildness of the species when at liberty, the individual now under consideration is most remarkable for its tameness; it will come readily to the call of the keeper and perch upon his hand or arm, and in the most gentle manner search his hand or anything he may hold in it for food. In doing this it exhibits a great amount of inquisitiveness and intelligence; if the closed hand is held near the ground the bird will grasp it with its foot, and in a very quiet way try to open it in order to obtain what may be held in the hand. The bird runs or hops upon the ground or upon the perches with equal ease; that is, it runs along the perches that are horizontal. It scratches on the ground, using the right and left foot alternately, grasping the clods of earth and pulling them over, examining the roots and underparts most minutely for the smallest seeds or insects.

The strength of the legs and feet will be better understood from the fact that the bird will drag about large clods of peat, earth, and roots upwards of 7 lb. weight. This I have ascertained by weighing the lumps of earth after the bird had so moved them. Unlike the gallinaceous birds, the Lyre-bird washes freely, and has never been seen to dust itself. It has a loud and fine voice; and, although I cannot say I have heard its song, the keepers, upon whose veracity I can place every confidence, assure me that the bird has frequently sung; and its notes are described to resemble those of a Thrush or a Blackbird in the commencement, but gradually become much louder. Its food consists of finely chopped meat mixed with a small quantity of bruised hempseed, earthworms, mealworms, ants' eggs, and grasshoppers, together with a small quantity of canary and millet seed. Like most insect-eating birds, the Lyre-bird throws up the pellets, usually called castings, of the indigestible portion of its food, such as the wing-cases and legs of beetles and other insects.

Having made myself tolerably well acquainted with the habits of this bird since its arrival in the Gardens, I feel inclined to offer an opinion with reference to its affinities; and in so doing I beg to refer to the habits as noticed in No. 45, vol. ii. of 'Land and Water,' in

which the writer describes the meeting of a number of male birds of this species, which he supposes were fighting and, as he says, making a most abominable noise.

A similar meeting of male birds is mentioned by Mr. Wallace as taking place with the great Bird of Paradise. Mr. Wallace says the male birds assemble together upon the tops of the tallest trees and utter their loud and not very pleasing notes.

This, together with what I have observed in captivity, both of the *Menura* and the smaller kind of Bird of Paradise, induced me to consider and search for other characters on which to found an opinion; I therefore take the *habits, voice, feathers*, and their arrangement (see Nitzsch's Pterylography, pl. 3. figs. 11-13), together with the skeleton. Having examined the skeleton of the *Menura* together with that of the Bird of Paradise and a true *Corvus*, I must say in general that the *Menura* and Bird of Paradise present a stronger likeness to each other than either of them exhibit towards the genus *Corvus*. In the breadth and form of the skull the *Menura* and Bird of Paradise resemble each other remarkably.

In conclusion, I have to remark that the strong and well-marked resemblance between these birds consists in the *voice, food, and mode of breeding*, the large size of the legs and feet, the form of the skull and skeleton, the structure of the feathers, and their arrangement on the body; and to this I may add, the bird belongs to the same geographical range as the true Paradise-bird: I regard it as an aberrant form, or rather as the terrestrial form, the true Paradise-bird being the arboreal form of the same group.

2. On the Form, Size, and Structure of the Viscera of the Hippopotamus, as compared with the same parts in the Members of the Pachyderm Family and in some other Animals. By EDWARDS CRISP, M.D., F.Z.S. &c.— Part II.

The inquiry I am about to institute is one of great interest; time, however, will only permit me to take a superficial glance at the subject. I may premise that, with the exception of the Rhinoceros and Babirussa, I have examined the visceral anatomy of all the pachyderms, weighed the various organs, and measured their size and capacity. I have also in my museum casts and drawings of the different viscera.

I will proceed with the examination as the subjects are arranged in my last paper. Of the skin-glands of the pachyderms I am unable to make a comparative estimate, either from my own investigations or from the observations of other anatomists; but in all these thick-skinned animals, especially in the Elephant, Rhinoceros, and Tapir, it is probable that large glands exist somewhat similar to those in the Hippopotamus, although I believe that none of the members

of this family have the same kind of coloured secretion from the cutaneous surface.

The description I have given of the stomach shows that it is one of the most remarkable, both in form and structure, among the terrestrial mammals. In addition to the small woodcut in my last paper I have placed a drawing before the Society representing the interior of this viscus of the natural size, so that its peculiarities can be readily seen. I also exhibit casts that I have made of the stomachs of the Porpoise and Dolphin, with other viscera, so that a comparison may be made of the gastric cavities of these animals. I likewise place before the Society a new method of teaching comparative anatomy (a plan I have shown at the present Paris Exhibition*). It consists in modelling the viscera in clay to scale, and then taking casts of the various parts, so that in a small compass (in the space of 10 or 12 square inches) the whole visceral anatomy of the animal is seen, as shown in the specimen of the viscera of the Hippopotamus before the Society. I do not apologize for this digression, as the subject is intimately connected with all anatomical and physiological inquiries, and it is one, I believe, that may be turned to great practical account.

Since my paper was brought before the Society, I have seen the following in the article "Pachydermata," in 'Todd's Cyclopædia,' vol. iii. p. 871:—"The stomach of the Hippopotamus, or, at all events of the foetal Hippopotamus, dissected by Daubenton, presents a very remarkable conformation. Externally it seems to be composed of three parts. The principal portion, extending from the cardiac extremity to the pylorus, was much elongated, resembling more a portion of intestine than an ordinary stomachal receptacle. Besides this central part, extending from the œsophagus to the pyloric valve, were two long appendages like two cæcums, one arising on the right side of the œsophagus and running along the exterior of the stomach throughout almost its entire length and then folding backwards, the other and shorter *cul de sac* issuing from the posterior aspect of the cardiac extremity of the stomach and projecting towards the right side. The construction of the interior of this stomach is still more extraordinary than its external appearance; for it is so divided by septa that food coming into this viscus through the œsophagus may pass by different channels either into the central portion, which seems properly entitled to the name of stomach, or into either of the great diverticula appended to it. The inferior walls of the central stomach have nine or ten cavities in them, something like those of the Camel and Dromedary. The lining membrane both of the stomach and diverticula is granular and wrinkled, except by the pylorus, where the parietes become smooth and folded into numerous plicæ somewhat resembling those of the third stomach of a ruminant, although there is no probability that rumination occurs in the animal under consideration."

It will be seen from my account, judging only from the specimen I have examined, that the parts described by Daubenton as appen-

* Viscera of the Gorilla, and other specimens.

dices are true and separate stomachs, that the cavities in the third stomach are not pouches like those of the Camel and Dromedary, and that there are no folds in the fourth stomach. In the new-born Hippopotamus, as in a young ruminant at birth, it is probable that the stomach would present some peculiarities not observed at a later period.

For the better understanding of this subject let me take a hasty glance at the gastric organ and parts of the intestinal apparatus in the various mammalian groups. In the quadrumana the stomach, except in the *Sennopithecii* that have three gastric cavities, is for the most part simple. The same may be said of the *Cheiroptera* and *Carnaria*. Among the Marsupialia the Kangaroos and Potoros (*Hypsiprymnus*) have two stomachs, with numerous pouch-like dilations externally. Among the rodents the stomach in most is partially divided, and the cæcum generally is very large. In the Edentata the *Bradypii* (Sloths) have a very large stomach, with four divisions. In the Pangolins (*Manis*) there is a slight division of the gastric organ. The ruminants, as is well known, have the most complicated form of stomach, not only as regards the shape of the four cavities, but more especially in relation to the numerous papillæ, villi, and folds on the mucous surface. The Cetacea present some of the most remarkable and unaccountable differences as regards the complication of the stomach. The stomach of the Porpoise and the Dolphin on the table fully exemplify this. In the former, which is 19 inches in length, there are four divisions—the two first rugous, the two last smooth. In the stomach of the Dolphin, which is narrow and 25 inches in length, there are seven divisions. The stomach of the Porpoise may be taken generally as a model for that of the larger Cetacea, four cavities being the usual number. It is very remarkable that the flesh-eating Dolphins should have a more complicated stomach than the herbivorous Cetacea, such as the Manatee, Dugongs, and Stellerines.

I now come to the Pachydermata; and it will be seen that great differences exist in the form of the stomach, as well as in the intestinal appendages, cæca, rugæ, villi, and intestinal glands. In the Pigs (*Suidæ*) the stomach is partially divided. The Peccaries (*Dicotyles*) have a sacculated stomach, with three principal divisions. The Rhinoceros has a simple stomach, as have also the Elephants and Tapirs. The stomach of the Hyrax has two compartments. In the Horses (*Equidæ*) the gastric cavity is simple. None of the pachyderms can be strictly said to have simple stomachs; for in all there is a division; but I use the term simple when there are no distinct valves or muscular folds to denote the boundaries.

On comparing the stomach of the Hippopotamus with that of the other pachyderms it will be seen that the viscus affords but little resemblance to any of them; nor does it to that of the other animals I have named with complicated stomachs. Probably, as regards external form, the stomach of the Manatee (*Manatus americanus*), from the forked appearance given by the two appendices, resembles that of the Hippopotamus more than any other animal; but the interior,

both as regards shape and the arrangement of the valves and rugæ, differs materially from the stomach of the Hippopotamus, which has a greater resemblance, in the distribution and form of the villi and in the appearance of the fourth cavity, to the villi and the stomach of a ruminant; indeed, looking to the mechanical arrangement of the muscular valves in the first three stomachs, it may naturally be asked does this animal ruminate?

Another important peculiarity in the Hippopotamus is the absence of a cæcum, the animal in this respect differing from the other pachyderms. As is well known, this cavity in the Elephant, Tapir, Horse, Zebra, Quagga, and Rhinoceros is very large, whilst in the Pigs it is of moderate size. In the little Hyrax it is very capacious, with two additional appendices towards the rectum. The villi, intestinal folds, and glands differ also materially from those of the other members of this family. The long villi and folds in the intestines of the Rhinoceros, the mucous folds in the stomach and small intestines of the Elephant, the rugous cæcum of the Tapirs, and many other peculiarities and differences might readily be pointed out.

I may here remark (and I speak from numerous and extensive examinations) that in the various orders of mammals none of them, as regards their visceral anatomy, have so great a general resemblance to each other as the ruminants.

Length of the intestinal canal.—All the pachyderms have a long alimentary tube, as will be seen by the following table of animals in which I have measured it:—

	feet.	in.
Male Asiatic Elephant*	106	0
Female Asiatic Elephant	123	0
Common Hog (<i>Sus scrofa</i>)	86	0
Wart Hog (<i>Phacochoerus æthiopicus</i>)	36	4
Ælian's Hog (<i>P. æliani</i>)	29	8
Red River-Hog (<i>Potamochoerus</i>), about the same length.		
Masked Hog (<i>Sus larvatus</i>), young	29	2
Japanese Hog (<i>S. japonensis</i>)	50	7
Barbary Hog	49	6
Peccary, Collared (<i>Dicotyles torquatus</i>)	31	0
Peccary, White-lipped (<i>D. labiatus</i>)	28	0
Hyrax (<i>Hyrax capensis</i>)	12	6
Tapir (<i>Tapirus americanus</i>)	72	0
Tapir	62	0
Dray Horse, old	108	0
Blood Mare, old	94	0
Zebra (<i>Equus zebra</i>)	67	0

According to Professor Owen the length of the alimentary canal of the Rhinoceros dissected by him was, in the female 73 feet, in the male 96 feet (Trans. 1862).

* In the article "Pachydermata," in 'Todd's Cyclopædia of Anatomy and Physiology,' p. 871, the prodigious extent of the intestinal canal of an Elephant seventeen years of age is said to be 58 feet 6 inches.

Judging from the length of the intestinal tube in this young animal, and assuming that the rate of increase would be somewhat similar to that of the Giraffe, the old Hippopotamus would possess an alimentary tube from 180 to 206 feet in length, far longer than that of any other pachyderm. Whilst upon this subject I may mention that the alimentary canal of the male Giraffe that died recently at the Gardens measured 245 feet.

The spleen, like that of the Hogs, Tapirs, Elephants, Rhinoceros, and Peccaries, is long and narrow, whilst in the Solidungula it is triangular. In the little Hyrax its shape is nearer to that of the *Equidæ*.

In the article "Pachydermata," in 'Todd's Cyclopædia,' p. 871, it is said "that the spleen in pachydermatous animals differs in no noticeable respect from that of other quadrupeds." But the spleen of the pachyderms is so peculiar as regards its form, in the situation of the vein, and in the arrangement of the venous valves, that it can scarcely be mistaken for that of any animal of a different class. Indeed this organ presents such a uniformity in shape, in the various divisions of the vertebrata, that the family to which the animal belongs may generally be told by it—a remark that will not apply to any other viscus.

The pancreas in the Hippopotamus, as might be supposed from the complicated stomach, is more branched than in the other pachyderms, and one portion of it is placed close to the pylorus, where probably a small duct enters; but, as I said in my first paper, I omitted to examine this part.

The liver in the pachydermata presents some curious differences in the number of its lobes; and in speaking of these I reckon only the main lobes that are seen on its upper surface, the elevations on the under part, as I have said before, not properly coming under the term lobe.

In the Hippopotamus, as I have stated, the organ is but slightly divided; in the Elephant it is also bilobular.

In the Rhinoceros (Owen) there are three lobes. The Hogs have a liver of four main lobes, and generally a pointed slip that may be called a fifth lobe. The liver of the Peccaries consists of four main lobes and of four smaller lobes; that of the Tapirs of three main divisions and of three supplementary lobes; whilst the liver of the little Hyrax has six main lobes. In the Horses (*Equidæ*) there are four chief lobes.

Gall-bladder.—The Hippopotamus*, Rhinoceros, Tapirs, Peccaries, Hyrax, and the *Equidæ* have no gall-bladder; but it is present in all the Pigs. In the Wart-Hog (*Phacochoerus*) it is very thick, and partly imbedded in the substance of the liver. In the Elephant, as figured in 'Todd's Cyclopædia,' it is seated between the coats of the duodenum, and has four compartments.

* Professor Owen (Trans. vol. iv. p. 44), "On the Anatomy of the Rhinoceros," attributes the absence of the gall-bladder in this animal to the small size of the stomach; but this explanation will scarcely apply to the Hippopotamus, nor will it, I think, to vertebrates generally—the Deer (*Cervidæ*) for example.

Kidney and Renal Body.—The kidney in the Elephant and Rhinoceros, like that of the Hippopotamus, is generally lobate; whilst in the Pigs, Tapirs, Peccaries, Hyrax, and members of the equine family it is entire. The renal body in the Hippopotamus is placed further from the kidney than in the other pachyderms, in which it is generally in contact with this organ. In the two Elephants that I examined (Proceedings, 1855, p. 187) the kidneys of the female were lobated, whilst those of the male were entire.

Organs of Generation.—All the animals belonging to this family have the generative organs largely developed. In the Pigs the testicles and seminal vesicles are very large. The penis is also large in all, that of the Tapir proportionately larger, I believe, than in any other of the class. The age of this animal precludes a comparative estimate as regards size; and the accidental loss of the organs, as I have said before, prevented my making an accurate dissection.

The tongue, like that of the Wart-Hog (*Phacochoerus æthiopicus*) is thin and broad at its anterior part. The white papillæ I have mentioned are seen in all the Pigs and in the Tapirs; but the form of the basal villi differs from that of the other pachyderms.

Larynx and Trachea.—One important difference in the larynx of the Hippopotamus is the pyramidal form of its summit and the great development of the laryngeal muscles. The os hyoides consists of the usual number of bones. The trachea is composed, as I have stated, of twenty-three rings, rather widely separated at the posterior part, as is seen in the dried larynx before the Society. The number of rings in the Horse and Zebra varies from 45 to 52; in the Elephant —, Rhinoceros (Owen) 30, Common Hog 28, Wart-Hog 28, Peccaries 33, Tapir (American) 32, and Hyrax 30.

So that, judging from this young animal, the Hippopotamus has the smallest number of tracheal rings of any of the pachyderm family.

The thyroid glands were perfectly distinct; whereas in some of the pachydermata, as in the Horse, there is a connecting isthmus as in Man.

The lungs consist chiefly of two lobes, as in the Seal, Dolphin, and Porpoise; in the Elephant —, Rhinoceros (Owen) 5, Tapirs 6, Hogs 6, Peccaries 7, Hyrax 6, and Horse 5. In some of these a very small lobe exists in addition.

The lobular divisions I have before described, I believe, are peculiar to the lungs of this quadruped, and are not found in the other pachyderms. In the above description both lobes are spoken of.

The heart, with the exception of that of the Elephant, is of a less rounded form in the other members of this group. The opening of the two superior cavæ into the right auricle only exists in the Elephant. There are also some important differences in the appendages to the muscular walls of the heart; but want of space prevents me from alluding to them on the present occasion. The most interesting point in connexion with the heart is its bifid character in the newly born animal, as mentioned by Gratiolet in the paper before cited; he says "C'est peut-être un indice de cette division du cœur qui a été signalé dans la *Rhytina*, les *Dugongs*, et les *Lamantins*."

In the heart of the Hippopotamus dissected, a very faint mark existed of the above-named division, but this would be entirely obliterated, I believe, in the adult animal. Dr. J. E. Gray places the Hippopotamus under *Elephantidæ*, and thinks that the form is allied to the *Halicoridæ*; but I fail to see the resemblance. The muscular band in the inferior cava described by Gratiolet is probably not found in the other pachyderms.

Brain.—All the pachyderms, with the exception of the Elephant, have small brains; that of this young Hippopotamus, as before stated, weighed $10\frac{1}{4}$ oz., and probably in the adult animal it would not exceed 20 oz. In an Elephant, weighing about 3 tons, I found the weight of the brain to be 12 lb. In a Tapir (*T. americanus*), weighing about 140 lb., the cerebral mass was 7 oz. 380 gr. In the Horse the brain weighs about 16 oz. In the Pigs it varies from 5 to 7 oz. In the Rhinoceros, as described by Professor Owen (Trans. 1862), the brain weighed 1 lb. $14\frac{1}{2}$ oz. In the other members of the Hog family, and in the Babirussa, Peccaries, Hyrax, Zebra, and Quagga, judging from the skull-cavities, the brains are of small size, indicating to a great extent the slight amount of intelligence of these animals.

From the above comparisons, as regards the visceral anatomy of the Hippopotamus, it will be seen that the animal differs in many important particulars from the other members of the pachyderm family. In my next paper I hope to investigate the microscopic anatomy of the intestinal tube, and to compare the osteology of the Hippopotamus with that of the other pachyderms.

3. On *Plethodon persimilis* of Gray.

By ST. GEORGE MIVART, F.L.S.

In the Zoological Society's 'Proceedings' for 1859* Dr. Gray described and figured a species of Newt, said to be from Siam, under the name *Plethodon persimilis*. The author justly remarked its striking similarity in size, form, colour, &c. to *Plethodon glutinosus* of North America, adding that he was at first inclined to believe that the specimens described were really American, and had been sent to Siam. From its great resemblance to the last-named species, Dr. Gray included the new one in the genus *Plethodon*.

Dr. Günther, in his 'Reptiles of British India'†, described again the typical specimens; but while noticing certain differences between them and *Plethodon glutinosus*, yet retained the species in the genus *Plethodon*.

Having recently had occasion to examine the specimens of *Urodela* preserved in the British Museum, when I came to the type specimens of *Pl. persimilis*, while struck with their similarity to specimens of *Pl. glutinosus*, I was startled by their alleged habitat.

* Proc. Zool. Soc. 1859, p. 230, pl. xix. f. 2.

† 1864, p. 439.

That a Newt from the south-eastern coast of Asia should resemble some North-American tailed amphibian could not have been so surprising, considering the American affinities of the Japanese forms; but that a species from *Siam proper* should resemble almost completely a genus otherwise exclusively North American and possessing no representative in the Palæarctic region* was a circumstance truly remarkable.

Mr. Wallace has indeed suggested an explanation (by means of certain presumed geographical mutations†) of the discrepancy existing between the ophidian and batrachian populations of Japan; but it seemed to me difficult to account in any similar way for the phenomenon under consideration.

It is true that though *Plethodon* is unrepresented in the Old World, unless by the so-called *Pl. persimilis*, yet the North-American genus *Spelerpes* has a near relative in Europe in the *Geotriton genei* of Tschudi‡, and has recently been extended to the Neotropical region by Professor Peters§; yet this hardly lessens the anomaly presented by the appearance of such a genus as *Plethodon* in the true Indian region. Accordingly I applied to Dr. Günther for any additional information I could obtain concerning the typical specimens. He at once, with great kindness, placed me in possession of facts which considerably altered the aspect of the question.

Mr. Mouhot, from whom the specimens were received, terminated his collections in the mountains of Laos, a very lofty region, to the north-east of Siam proper. The last specimens received from Mr. Mouhot were from that locality, and were without any notes, having been brought down after his death by his servants. The typical specimens of *Pl. persimilis* were received also without any notes; and Dr. Günther entertains no doubt that they formed part of his last collection, *i. e.* that they came from the Laos Mountains.

Supposing, as I have little doubt, that such was really the case, then the probability of finding American forms is largely increased, as we are, in these mountains, no longer in Siam proper, and, moreover, at an altitude such as fairly to warrant the expectation of the appearance of Palæarctic animals. That Japanese forms (*i. e.* *Urodela* allied to certain American kinds) should here make their appearance would not then be so surprising, the more so as Dr. Günther informs me that the reptiles of the island of Formosa have considerable American affinities; and though Newts have not yet been

* Dr. Günther, in his highly interesting and instructive paper on the "Geographical Distribution of Reptiles," says, speaking of Batrachians, "Palæarctic and Nearctic regions resemble each other more than any third" (P. Z. S. 1858, p. 390).

† Nat. Hist. Review, vol. iv. 1864, p. 114.

‡ Batrach. pp. 59 & 94, t. 2. f. 3.

§ Namely his *Spelerpes (Edipus) adspersus* from Bogota (Monatsberichte der k. p. Akad. der W. z. Berlin, 1863, p. 468). But as allied forms are being discovered in the tableland of Mexico (*e. g.* *Spelerpes cephalicus*, *S. osculus*, and *S. lineolus*, Cope, Proc. Acad. Nat. Sc. Philad. 1865, pp. 196, 197), it is not improbable that other species will be found to have extended into, or to be represented by modified descendants in, the mountain-regions of Northern South America.

found there, yet he fully expects that such will eventually be discovered. Nevertheless, though the appearance of some American tailed amphibians was thus rendered less unlikely, yet the appearance of such a genus as *Plethodon*, which has no representative in Japan, was somewhat startling, and I therefore examined the specimens with great interest and as carefully as I could.

Dr. Günther, as before said, has detected several differences between *Pl. glutinosus* and the species under consideration; he gives the distinctions thus:—

“Pl. glutinosus.

Limbs feeble.

The length of the fore limb is considerably less than one-half of the distance between fore and hind limbs.

The length of the hind limb is one-half of the distance between fore and hind limbs.

The third and fourth toes are much shorter than the cleft of the mouth.

Trunk with thirteen lateral cross folds.

Tail subcylindrical at the base.

Tongue large, covering the whole bottom of the mouth, its hind margin being free.

The series of palatine teeth is distinctly interrupted in the middle.

Pl. persimilis.

Limbs well developed.

The length of the fore limb is one-half the distance between the fore and hind limbs.

The length of the hind limb is considerably more than one-half of the distance between fore and hind limbs.

The length of the third and fourth hind toes equals that of the cleft of the mouth.

Trunk with twelve lateral cross folds.

Tail compressed at the base.

Tongue narrow, elliptical, not covering the whole width of the bottom of the mouth, without free posterior margin.

The series of palatine teeth is subcontinuous.

“In other respects both species are very similar, the Siamese form being black, with small scattered whitish spots.”

In addition to these differences, I find that the Asiatic species is *entirely destitute of sphenoidal teeth*, which, on the other hand, are characteristic of the genus *Plethodon*. The species which undoubtedly belongs to the latter genus have, moreover, the first digit of each extremity extremely short, which is not the case with *P. persimilis* of Gray. Finally, in the Asiatic species (*P. persimilis*) the phalanges of the manual digits (counting from the radial to the ulnar side) are 2, 2, 3, 2 respectively, and the pedal digits (counting from the tibial to the peroneal side) have 2, 2, 3, 4, 2 phalanges; while in *Plethodon glutinosus* the numbers are 1, 2, 3, 2 in the manus, and 1, 2, 3, 3, 2 in the pes.

These differences, when taken into consideration with the peculiar geographical conditions, fully warrant the generic separation of the species now under consideration from the *Plethodon glutinosus*.

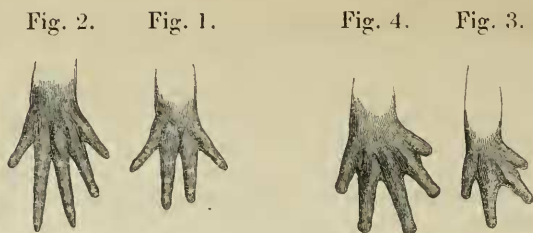


Fig. 1. Dorsum of right manus of *Pectoglossa persimilis*.
 2. Dorsum of right pes of *Pectoglossa persimilis*.
 3. Dorsum of right manus of *Plethodon glutinosus*.
 4. Dorsum of right pes of *Plethodon glutinosus*.

Indeed I believe there may be more grounds for associating it with the Japanese form *Onychodactylus* than with the last-mentioned American species, an arrangement which would harmonize well with the facts of geographical zoology. Nevertheless, as it has not nail-like processes on the digits, nor yet a preloacal fold, both of which exist in the last-mentioned genus, I think it better to place it in a genus by itself, for which I propose the name *Pectoglossa**, retaining of course the specific name chosen by Dr. Gray; so that the species will be named *Pectoglossa persimilis*.

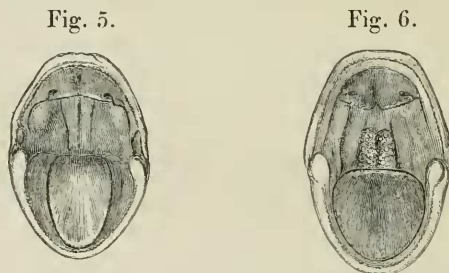


Fig. 5. Inside of mouth of *Pectoglossa persimilis*.
 6. Inside of mouth of *Plethodon glutinosus*.

In the fixed condition of the posterior part of the tongue *Pectoglossa* agrees with both *Hynobius* and *Onychodactylus*; but the transverse position of the palatine teeth causes it more to resemble the latter genus.

I am inclined to think that when the skull comes to be examined it will be found that there are two distinct premaxillary bones. The characters of the genus may perhaps be thus expressed:—

PECTOGLOSSA.

Toes 4/5, first of each manus rather long, first of each pes not very short; digits with rounded ends and no simulation of nails;

* Πηκτός, γλωσσα.

phalanges of four digits of manus 2, 2, 3, 2, of five digits of pes 2, 2, 3, 4, 2; no fold in front of the cloacal aperture; tail rather thick, yet compressed at base; no parotids; twelve costal folds on each side between axilla and groin; palatine teeth forming a transverse, slightly undulating, but subcontinuous series; no sphenoidal teeth; muzzle not projecting beyond the end of the mandible; tongue entirely fixed, behind as well as in front, and only somewhat free at each side; no postorbital arch or process (?); two premaxillæ (?); carpus and tarsus ossified (?).

Hab. Laos Mountains?

Thus, if the generic distinctness of this form is to be considered established, we shall have that degree of relationship to American forms which, under the circumstances above mentioned, is not anomalous, while we shall not have that close affinity to a peculiarly American form which was at first suspected to exist, and which would be so very anomalous if found in a species belonging to the *true* Indian region, whence *P. persimilis* was at one time supposed to have come.

4. On some New or imperfectly known Fishes of India.

By Surgeon FRANCIS DAY, F.Z.S., F.L.S., Principal Medical Storekeeper, Madras Army.

During the last month I have obtained the following species of fish, amongst many others, from the sea and fresh waters in the neighbourhood of Madras.

SERRANUS RADIATUS, sp. nov.

B. vii. D. 11/15. P. 19. V. 1/5. A. 3/8. C. 15. L. l. above 120.

Length of specimen 4 inches.

Length of head $\frac{1}{3}$, of pectoral $\frac{1}{5}$, of base of dorsal spines $\frac{2}{7}$, of base of dorsal rays $\frac{1}{7}$, of base of anal $\frac{1}{7}$, of caudal $\frac{1}{6}$ of the total length. Height of head $\frac{2}{9}$, of body $\frac{2}{7}$, of dorsal spines $\frac{1}{8}$, of dorsal rays $\frac{1}{7}$, of ventral $\frac{2}{11}$, of anal $\frac{1}{7}$ of the total length.

Eye transversely oval, its upper margin near the profile; diameter $\frac{2}{7}$ of length of head, 1 diameter from end of snout, $\frac{1}{2}$ a diameter apart.

General appearance rather elongated, and the dorsal profile slightly more convex than the abdominal.

Lower jaw the longest; the posterior extremity of the upper jaw reaches to beneath the posterior margin of the orbit. Præopercle slightly oblique posteriorly, which is serrated, three strong denticulations at its angle, its horizontal margin entire. Sub- and interopercles entire. Opercle with three flat spines, the central one of which is the longest.

Teeth in strong recurved villiform rows in both jaws, and a canine on either side of the centre of the upper. Teeth on vomer and palate in villiform bands, but much smaller than those in the jaws.

Fins. Dorsal spines moderately strong, and nearly as high as the rays, the interspinous membrane but slightly emarginate. Anal—first spine half as long as the second, which is of equal length but weaker than the third. Caudal wedge-shaped, its central rays being slightly the longest.

Scales small.

The lateral line is parallel with the back in the upper third of the body.

Colours. For the most part greenish olive, becoming dull yellow on the abdomen. An irregularly shaped, broad, whitish blue band passes from the posterior superior margin of the orbit across the occiput to meet a similar one from the opposite side. Two more pass from the lower and posterior margins of the orbit to the base of the pectoral fin. Another proceeds from the upper margin of the præopercle, at first backwards; and opposite the posterior third of the pectoral it curves upwards to the middle of the hard dorsal, on to which it is continued. A small patch of colour similar to these bands is present in front of the base of the dorsal. Another band proceeds from the posterior extremity of the pectoral to the anterior portion of the soft dorsal. Two more similar vertical bands cross the base of the tail, and several shorter marks exist over the body. Hard dorsal nearly black; soft dorsal and other fins yellow. Eye golden.

SERRANUS GRAMMICUS, sp. nov.

B. vii. D. 11/12. P. 19. V. 1/5. A. 3/8. C. 17. L. l. 90.

Length of specimen 15 inches.

Length of head $\frac{2}{7}$, of pectoral $\frac{1}{7}$, of base of dorsal spines nearly $\frac{1}{4}$, of base of dorsal rays $\frac{1}{5}$, of base of anal $\frac{1}{6}$, of caudal $\frac{1}{7}$ of the total length. Height of head $\frac{1}{5}$, of body $\frac{2}{7}$, of dorsal spines $\frac{1}{11}$, of dorsal rays a little more than $\frac{1}{9}$, of anal spines $\frac{2}{15}$, of anal rays $\frac{1}{6}$ of the total length.

Eye. Upper margin close to the profile; diameter $\frac{1}{5}$ of length of head, 1 diameter apart, $1\frac{1}{3}$ diameter from end of snout.

Body rather elongated; dorsal and anal profiles equally convex.

Cleft of mouth rather deep; posterior extremity of upper jaw extending to beneath the posterior margin of the orbit. Vertical limb of præopercle slightly produced at its angle, finely serrated in its upper two-thirds, becoming coarser lower down, and with five moderately large denticulations at its angle; horizontal limb entire, as are also the sub- and interopercles. Operculum with three spines, the central one of which is much the strongest.

Teeth villiform in both jaws, becoming most developed in the centre, and a small canine on either side of the upper jaw. Villiform teeth on vomer and palate in size about equal to the smallest on the jaws.

Fins. Dorsal spines moderately strong, the fourth being the longest, the last being two-thirds the height of the first ray; the soft portion of the fin slightly rounded posteriorly. Pectoral rounded.

Ventral rather pointed. Anal—first spine short, second strongest, the last one-fourth the longest; soft portion rounded. Caudal cut nearly square.

Scales small, in rows passing obliquely upwards and backwards above the lateral line, and horizontally below it.

Lateral line in upper fifth of body.

Colours. Greyish, with a golden gloss about the head. A narrow black line passes from the upper margin of the orbit to the last dorsal spine. A second line passes downwards from the upper third of the orbit to the superior spine of the operculum, whence it proceeds to the base of the sixth dorsal ray. A third and similar band commences at the lower margin of the orbit, and, passing beneath the central spine of the operculum, is continued to the upper third of the caudal fin, where it takes the form of rounded blotches. Dorsal fin with a row of black spots along its centre, and a black external edging. Caudal with numerous black spots, and a black margin. Anal black-tipped. Eye golden.

This description is that of a male specimen.

MESOPRION RUSSELLI, Bleeker.

Antika doondiawah, Russell, pl. 98.

B. vii. D. 10/14. P. 16. V. 1/5. A. 3/8. C. 17. L. 1. 54. L. tr. 9/20.

The length of specimens varies up to 13 inches.

Length of head $\frac{2}{3}$, of pectoral $\frac{1}{4}$, of base of dorsal spines more than $\frac{1}{4}$, of base of dorsal rays $\frac{1}{6}$, of base of anal $\frac{1}{8}$, of caudal $\frac{1}{5}$ of the total length. Height of head rather more than $\frac{1}{4}$, of body $\frac{1}{3}$, of dorsal spines $\frac{1}{8}$, of dorsal rays $\frac{1}{10}$, of ventral $\frac{1}{6}$, of anal spines $\frac{1}{11}$, of anal rays $\frac{1}{8}$ of the total length.

Eyes rather longer than high; diameter $\frac{1}{4}$ of length of head, $1\frac{1}{4}$ diameter from end of snout, $\frac{2}{3}$ of a diameter apart.

Body ovoid, compressed. Dorsal profile rather more convex than the abdominal.

Lower jaw slightly the longest; the posterior extremity of the maxilla extends to beneath the anterior third of the orbit. Præopercle with a very shallow emargination in the lower third of its vertical limb, which has also a few small serrations upon it; horizontal limb crenulated. Scapular serrated.

Teeth. An external row of widely separated conical teeth in either jaw, those in the lower the largest, and increasing in size posteriorly. A pair of large canines in upper jaw, with a smaller one contiguous. A row of very fine villiform teeth in both jaws posterior to the conical row. Villiform teeth in vomer and palate.

Fins. Dorsal spines rather weak, the third much the longest; interspinous membrane rather deeply emarginate; last spine not so long as the first ray. Pectoral pointed. Ventral pointed, spine weak. First anal spine short and weak, two last of equal length, but the middle spine much the strongest. Caudal emarginate, its base broad.

Scales in oblique rows, passing backwards and upwards above the lateral line, and in horizontal rows below it. Some exist over dorsal and anal rays.

Lateral line follows the curve of the back in the upper fourth of its course; it is in single tubes.

Colours. Rosy, with four oblique brilliant golden lines passing from the lateral line upwards and backwards, impinging on two rows of scales, leaving two intermediate rows without such lines. Four similar golden lines are also present below the lateral line: the first proceeding from the posterior margin of the orbit to the lateral finger-mark; the second from the middle of the operculum to opposite the end of the soft dorsal, where it is lost on the lateral line; the third from beneath the orbit to the base of the caudal fin; the fourth from the lower margin of the base of the pectoral to the base of the anal. A large, deep black finger-mark exists on the lateral line opposite to the commencement of the soft dorsal. Pectoral, ventral, and anal yellowish. Dorsal and caudal pinkish. Eyes silvery, with a dark mark below the pupil.

Following the opinion of Cuvier and others, and not having seen a specimen of Russell's fish, I had previously considered this to be the *Genyoroge notata*, C. & V. Since my arrival in Madras I have had ample opportunities of investigating the species, which I find to be a *Mesoprion*, and apparently the *M. russelli* of Dr. Bleeker.

UPENEOIDES BIVITTATUS, Cuv. & Val.

This fish is very similar to the *U. vittatus*, C. & V., with which, indeed, Dr. Günther has placed it. But there are certain evident differences, which I propose adverting to.

Its barbules extend to beyond the posterior margin of the operculum; its caudal is more deeply lobed; its lateral line is more raised; and it possesses a rather thick and large air-bladder, which the *U. vittatus* is without.

The coloration likewise differs. The *Upeneoides bivittatus* is darker along the back; its golden stripes are not so well marked; and the caudal has two horizontal brown lines on either side of its centre, and three oblique bands running across the upper lobe and two across the lower lobe.

In the *Upeneoides vittatus* the caudal has six yellowish-brown bars with dark edges across the upper lobe, and a black extremity, whilst on the lower lobe there are also three oblique bars, and the extremity is white. The first dorsal is also black-edged.

URANOSCOPUS MARMORATUS, C. & V.

B. vi. D. $4\frac{1}{12}$. P. 18. V. $1\frac{1}{5}$. A. 13. C. 11.

Length of specimen $5\frac{5}{10}$ inches.

Length of head nearly $\frac{2}{3}$, of pectoral $\frac{1}{4}$, of base of first dorsal $\frac{1}{11}$, of base of second dorsal $\frac{1}{4}$, of base of anal $\frac{1}{4}$, of caudal $\frac{2}{11}$ of the total length. Height of head $\frac{1}{11}$, of first dorsal $\frac{1}{9}$, of second dorsal $\frac{1}{7}$, of anal $\frac{1}{11}$ of the total length.

Eyes directed upwards and slightly outwards, $\frac{2}{3}$ of a diameter from end of snout, and rather more than 1 diameter apart.

Body, in circumference largest anteriorly, gradually decreasing towards the tail. Head depressed. Body compressed.

Mouth oblique, closed anteriorly by the under jaw, so that it is directed upwards; the posterior margin of the upper jaw extends to beneath the centre of the orbit. There are five præopercular spines at equal distances apart, the anterior of which is directed forwards. The upper surface of the head nodulated, a moderately large suprascapular, and very large humeral spines. Præorbital roughened, large, and slightly constricted where its anterior joins its middle third.

Teeth villiform in jaws, vomer, and palate.

Fins. Ventrals jugular. Pectoral large and rounded. Caudal rounded.

Scales minute, and having raised edges.

Lateral line proceeds backwards from suprascapular spine, and, passing along parallel with the back, arrives at the upper third of the base of the caudal fin, when it bends down to its centre, but is not continued between its rays.

Colours. Chestnut-brown, becoming bluish white on the abdomen. The whole of the upper half of the head, front of lower jaw, and body covered with bluish-white spots. Fins darkish grey, edged with white. Ventral and anal lighter; the upper three-fourths of the first dorsal deep black. Eyes golden.

SCORPENA ROSEA, sp. nov.

B. vii. D. $11\frac{1}{10}$. P. 17. V. $1\frac{1}{5}$. A. $3\frac{1}{5}$. C. 15. L. 1. 43. L. tr. $7\frac{1}{18}$.

Length of specimen 5 inches.

Length of head $\frac{1}{3}$, of base of dorsal spines nearly $\frac{1}{3}$, of base of dorsal rays $\frac{1}{6}$, of pectoral $\frac{1}{4}$, of base of anal $\frac{1}{10}$, of caudal $\frac{1}{5}$ of the total length. Height of head $\frac{1}{4}$, of body $\frac{1}{3}$, of dorsal spines $\frac{1}{7}$, of dorsal rays $\frac{1}{7}$, of ventral $\frac{1}{5}$, of anal spines $\frac{1}{6}$, of anal rays $\frac{1}{5}$ of the total length.

Eyes. Orbits raised, with depressions anterior and posterior to them, having also a deep concave interorbital groove, with an elevated line on either side which does not become spiny. Diameter of eye $\frac{1}{4}$ of length of head, $\frac{3}{4}$ of a diameter from eye to eye, $1\frac{3}{4}$ diameter from end of snout.

Dorsal profile more convex than the abdominal. Head compressed.

Snout rather elevated, a transverse depression between it and the orbits. Cleft of mouth oblique; posterior extremity of the maxilla extending to beneath the centre of the orbit; lower jaw the longest. Posterior nostril circular, situated in the transverse groove behind the snout, and having a short sharp spine a short distance anterior to it; the anterior nostril tubular, just anterior and external to this spine, and having a broad fleshy tentacle above it, which is

fringed externally. A short distance external to the posterior nostril is a sharp spine, leading backwards from which to above the angle of the præoperculum is a spiny ridge containing five more directed backwards. Along the angle and lower border of præoperculum are three denticulations—the superior a strong spine, the others blunted; there are also three fleshy tentacles along its border, and one on the side of the præoperculum. Interoperculum with a blunt spine and tentacle. Operculum with a bony ridge along its centre, ending in two spines. A ridge containing three spines passes from the posterior inferior margin of the orbit to the upper margin of the opercle and commencement of the lateral line, and has two minute spines below it. Another spiny ridge extends from the posterior superior margin of the orbit backwards, and one spine between it and the ridge below it. Orbit with a strong spine at its anterior superior margin, one at its posterior superior margin, and one at its superior margin, which has attached to it a long wide tentacle on a narrow base. Several fleshy tentacles exist along the edge of the snout, a large one above the angle of the mouth, and two on the extremity of the upper jaw; there are also three rather large ones on the lower jaw.

Teeth villiform, in numerous rows in both jaws, also in a V-shaped patch on the vomer, but none on the palate.

Fins. Dorsal spines moderately strong, the third the longest; interspinous membrane rather deeply cleft, and extended beyond each spine. Pectoral broad at its base, its twelve lower rays unbranched, and minute fleshy appendages attached to them. Ventral spine strong. Anal—first spine short, second and third of equal length, but the second twice as strong as any in the fish. Caudal cut square at its extremity.

Scales in rows proceeding backwards and upwards. Some on the upper part of the operculum; head otherwise scaleless.

Lateral line in twenty-three or twenty-four tubes.

Colours. Of a general rose-colour, marbled with greyish; the spines on the head are darker than the surrounding parts. One or two irregular grey bands with dark edges exist on the tail. The dorsal and anal are also banded; and the pectoral has numerous bands on it.

This species differs from the *S. venosa*, C. & V., which has no orbital tentacle, and of which the third anal spine is the longest and strongest, and the caudal fin is rounded, &c.

CARANX NIGRESCENS, sp. nov.

B. vii. D. $7\frac{1}{19}$. P. 19. V. $1\frac{1}{5}$. A. $2\frac{1}{17}$. C. 19. L. 1. 25.

Length of specimen 24 inches.

Length of head nearly $\frac{1}{5}$, of pectoral $\frac{2}{7}$, of base of first dorsal $\frac{1}{11}$, of base of second dorsal $\frac{1}{3}$, of base of anal $\frac{2}{7}$, of caudal $\frac{2}{9}$ of the total length. Height of head $\frac{2}{9}$, of body $\frac{2}{7}$, of first dorsal $\frac{1}{12}$, of second dorsal $\frac{1}{8}$, of ventral $\frac{1}{12}$, of anal $\frac{1}{6}$ of the total length.

Eyes with very narrow adipose lids; diameter $\frac{1}{3}$ of length of head,

$1\frac{1}{2}$ diameter from end of snout, $1\frac{1}{4}$ diameter apart, and $\frac{3}{4}$ of a diameter from the dorsal profile.

Body compressed. Dorsal and abdominal profiles equally convex.

Head compressed, and having an elevated central ridge. Præorbital wide, equal in extent to $1\frac{1}{2}$ diameter of the orbit. Præopercle—its posterior limb rather oblique; its lower margin lineated towards the edge, which is crenulated. Sub- and interopercles also crenulated.

Teeth in numerous villiform rows, of equal size in both jaws, with a slight interval at symphysis. A triangular patch of villiform teeth on the vomer; and a long narrow band of the same character on the palate.

Fins. Pectoral rather in advance of the origin of the dorsal and ventral; anal arises under about the sixth ray of the second dorsal. First dorsal nearly triangular; second dorsal highest anteriorly, its upper margin rather concave in its first portion, subsequently parallel with the back. Pectoral falciform, reaching to opposite the tenth dorsal ray. Dorsal spines weak, the first very short, the third and fourth the longest. First ray of second dorsal the longest in the fin; the last does not quite reach the base of the caudal. Anal spines weak, the second the longest.

Scales cover the body, under the eyes, and the upper portion of the opercles; there are none on the chest. There is a moderately high sheath to the dorsal and anal fins.

Lateral line with a very moderate curve to opposite the thirteenth dorsal ray, whence it becomes straight. The keel is slightly developed—in fact, being only very distinct on the last eight scales. A lateral ridge on either side of the keel on the root of the caudal.

Cæcal appendages very numerous.

Colours. Of a dusky greyish, with innumerable fine black points, and generally glossed with purple. A well-marked black spot upon the operculum. Fins nearly black, especially the dorsal.

This description is that of a male specimen.

Of the genus *Panchax*, Cuv. & Val., I have obtained two species at Madras, and one from Malabar. Before describing these, I may remark that I have not as yet met with the *Panchax* (*Esox*) *panchax*, Buch. Ham.

The *Panchax lineatum*, C. & V., is exceedingly common in Malabar; but I have not taken it as yet on the Madras side of the Western Ghawts.

The *Panchax* (*Aplocheilus*) *rubrostigma*, Jerdon, and another species which I am unable to refer to any existing description, and have therefore considered new, are both exceedingly common in all tanks, streams, and pieces of fresh water around Madras.

These two species are very dissimilar in their appearance; and I have kept a number in an aquarium, where they grow rapidly and become very tame. They are carried in water with great difficulty, and rapidly die when out of their native element. They swim very close to the surface of the water, and appear to require a large amount of oxygen.

PANCHAX ARGENTEUS, sp. nov.

B. iv. D. 6. P. 15. V. 6. A. 20. C. 13. L. l. 27. L. tr. 11.

Length of specimens from $\frac{1}{5}$ to $1\frac{2}{10}$ inch.

Length of head nearly $\frac{1}{4}$, of pectoral $\frac{1}{4}$, of base of dorsal $\frac{1}{10}$, of base of anal $\frac{2}{7}$, of caudal $\frac{1}{4}$ of the total length. Height of head $\frac{1}{6}$, of body $\frac{1}{4}$, of dorsal fin $\frac{1}{5}$, of ventral $\frac{1}{8}$, of anal $\frac{1}{6}$ of the total length.

Eyes. Diameter $\frac{2}{5}$ of length of head, $\frac{2}{3}$ of a diameter from end of snout, nearly 1 diameter apart.

Teeth in a narrow villiform row, directed at first almost horizontally, and bent near their extremities.

Fins. Dorsal is situated over the last few rays of the anal, which last commences midway between end of snout and termination of the caudal fin, which is cut square. Ventrals, if laid forwards, just reach to the opercles; if in their natural position, they extend beyond the vent to the first anal ray.

Scales on the top of the head with smooth edges and not festooned; those on chest much smaller than those on the body.

Body very compressed; back wide and flat.

Colours. Of a dullish green along the back, becoming dirty white along the abdomen. The back and also between the rays of the anal and caudal fins finely dotted with black points; otherwise the fins are diaphanous. Eyes blue.

This species, which appears never to grow to a large size, seems allied to the *Panchax cyanophthalmus*, Blyth, which, however, is said to have 22–23 anal rays. It differs from the *Panchax (Pæcilia) latipes*, Schleg., in the length of the head, and in the number of the dorsal and anal rays, in the number of scales, and in the position of the ventral fin. It may be the *Panchax m'clellandi*, Bleeker; but as that species is only known from a drawing, it is impossible to decide the question.

PANCHAX RUBROSTIGMA, Jerdon.

B. iv. D. 8. P. 15. V. 6. A. 14–15. C. 15. L. l. 27. L. tr. 7.

Length of specimens from $1\frac{2}{10}$ to $1\frac{6}{10}$ inch.

Length of head $\frac{2}{9}$, of pectoral $\frac{1}{7}$, of base of dorsal $\frac{1}{14}$, of base of anal $\frac{1}{7}$, of caudal $\frac{1}{11}$ of the total length. Height of head $\frac{1}{7}$, of body $\frac{1}{5}$, of dorsal $\frac{1}{7}$, of ventral $\frac{1}{7}$, of anal $\frac{1}{7}$ of the total length.

Eyes oval, $\frac{2}{5}$ of length of head, $\frac{2}{3}$ of a diameter from end of snout, $1\frac{1}{4}$ diameter apart.

Body elongated; back moderately flat from the snout to the base of the dorsal fin; sides compressed.

Length of intermaxillaries in central line equal to about half the diameter of the eye. The posterior extremity of the maxilla extending to beneath the centre of the orbit. Angle of præoperculum rounded, but not produced.

Teeth in both jaws villiform, recurved, and in a narrow band.

Fins. Anal commences midway between snout and termination of caudal fin. The dorsal begins over the last four anal rays. Caudal wedge-shaped, its central rays the longest.

Scales cycloid ; two rows between eye and angle of præoperculum ; those on the summit of the head with their posterior border festooned.

Colours. Of a dull green on the back and sides, and dirty white along the abdomen. Numerous small and brilliant blue spots along the sides, alternating with rusty-red ones when the fish is alive and in good health, but they fade after death. A light spot on the summit of the head, which is sometimes absent. Dorsal fin white, with a large black spot along its base. Anal orange. Eye silvery.

5. Preliminary Description of a New Species of Finner Whale
(*Balenoptera bonaërensis*). By DR. H. BURMEISTER,
F.M.Z.S., Director of the Public Museum, Buenos Ayres.

The animal which I now bring before the notice of the scientific public was found dead, floating on the river Plata, near Belgrano, about ten miles from Buenos Ayres, by a fisherman, who brought the body on shore on the 5th of February of this year, and informed me on the next day of his discovery. I was then confined by illness to my room, and was unable to go to see the body until fourteen days later. Putrefaction had already destroyed the Whale's external appearance ; but as I found the body lying on the ground near the shore I was able to take a sufficiently accurate measure of it by steps. It was then 16 paces long, of which nearly 4 belonged to the head, and 12 to the trunk with the tail. Calculating my steps in moderate walking as equal to 2 feet, I made the whole body 32 feet long ; and now measuring the skull alone I find it is 7 feet long, leaving 25 feet for the trunk and tail. This 25 feet is divided in the skeleton in such a manner that 1 foot is occupied by the seven vertebræ of the neck, $3\frac{1}{2}$ feet by the eleven dorsal vertebræ, $8\frac{1}{2}$ feet by the twelve lumbar, and 10 feet by the nineteen of the tail, the 4 additional feet being for the external parts of the animal—the skin, the cellular covering under it, and the intervertebral cartilages.

As the surface was already destroyed by putrefaction, I could not see distinctly the eyes, the ear-openings, or the nostrils. I only observed that the under jaw was about 4 inches longer than the tip of the skull and surrounded the upper jaw in its whole circumference.

Ten paces from the tip of the nose was a triangular falcate dorsal fin about 1 foot high and $1\frac{1}{2}$ foot long ; and on the tip of the tail a large caudal fin with the usual two lobes, about $6\frac{1}{2}$ feet distant from each other at the hinder ends, and each $5\frac{1}{3}$ feet long, and $1\frac{1}{2}$ foot broad at the beginning.

The pectoral fins I could not examine very exactly—the one being already destroyed, and the other covered by the body ; but they appeared to have the usual triangular form, and a length of from $3\frac{1}{2}$ to 4 feet. The rest of the skin was of a dark black-grey colour, like the old clay-slate, but lighter and nearly white-grey on the under-

side. Here I observed the usual deep furrows from the inner edge of the under jaw to the middle of the body; each furrow was $\frac{1}{2}$ inch deep, and the flattened intervals 1 inch broad.

The animal was a male, with two hinder longitudinal openings—the former (somewhat in advance of the position of the dorsal fin) being the sexual opening, and the hinder (under the same fin) the anus. On the fore side of this second opening are the two small mammarial fissures.

Of the internal organs nothing was to be seen, these being already destroyed by putrefaction and eaten by some millions of larvæ of *Musca*, which resembled living waves consuming the whole organic substance of the carcass.

Even the whalebones of the mouth had fallen out, and no trace of them was to be seen on the shore; but one month later we had the good fortune to find one side of them very well preserved in the ground of the river some miles higher up.

The fisherman told me that when he found the body the mouth was already open, and without whalebones, the tongue being very much swollen, like a balloon. This may have forced the whalebones from their position.

Since this first inspection I have visited the body from time to time to preserve the bones for the Museum. During the last week all the bones were brought to the establishment, and have been arranged in such a manner that I can give a short description of the whole skeleton.

Beginning with the skull, I will not describe its general form, which is very well shown in the figure of the skull of the European *Balænoptera rostrata* in the 'Voyage of the Erebus and Terror,' Mammalia, pt. 2, and the description given by my friend Dr. J. E. Gray in the same work.

Comparing the skull of this new species with his figure, I find that it is certainly much larger, but presenting the same relation between the two principal portions, being from the tip to the nasal bones 4' 4" long, and from these to the occipital foramen 2' 8". But there is some difference in the construction of this hinder portion, as the fore end of the vertex reaches to the hinder end of the nasal bones, covering entirely by its middle prolonged protuberance the small frontal bone from above. Much smaller also in my skull is the lateral part of the same bone, which forms the orbital cavity, and somewhat stronger the hinder lateral process of the temporal bone to which is attached the under jaw.

These differences leave no doubt that the two animals belong to different species. The transverse extent of the front part immediately before the nasal bones is 2' 10", that of the hinder angles of the frontal bones behind the orbit is 4', and that of the vertex behind across the occipital foramen 2' 6". The lower jaw is, including the curve, 7' 5" long on the outside.

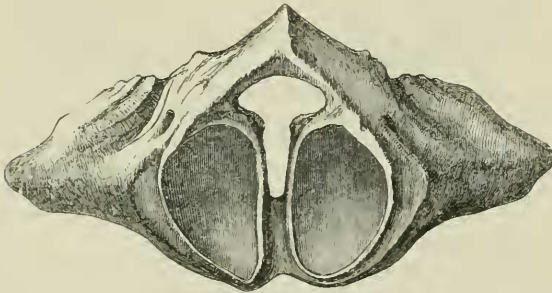
The whale-bone, which was attached to the underside of the large excavated maxillary bones, is of the usual form and construction. We have the left side nearly complete, wanting only a small portion

of the hinder end. The remaining part is composed of 192 plates; and from the form of the last it may be supposed that a series of 30 or 40 plates is lost on the hinder end, so that the whole series of plates may have been from 230 to 235. The first plates are very small, not higher than 3 inches, of which 2 inches are long bristles; but the hinder plates are 12 inches high without the bristles, and the bristles here are more than 3 inches long. These hinder plates have a base 7 inches broad and an elongated triangular figure, the side with the bristles being the largest, like the hypotenuse of the triangle, and somewhat curved to the exterior.

It is well known by the description of different authors* that there are three or even four series of plates in the internal basal margin of the larger external series. In my specimen the second series of plates is preserved, but the two or three smaller most internal series are lost. The plates of this second series are of the same triangular figure, but no higher than $\frac{1}{2}$ to 3 inches, with short bristles of $\frac{1}{2}$ inch on the inside. All these interior plates are of a white colour in my specimen; and of the same colour is also the whole inside of the large external series, every plate of that series being black on the outer margin for a space of 2 inches.

The neck is composed in the usual manner of seven small vertebræ, of which the second, third, and fourth are united together by the bodies and by ossified commissures on the central portion of the arch. The first or *atlas* (fig. 1, anterior surface) is much broader

Fig. 1.

Anterior surface of atlas of *B. bonaërensis*.

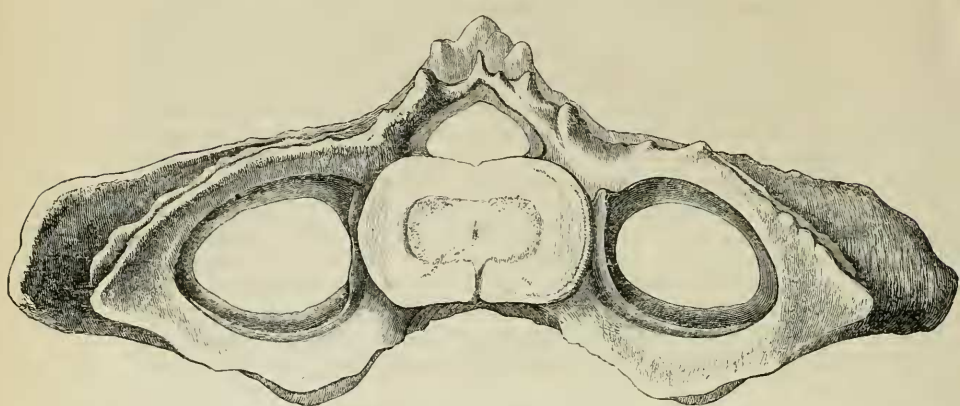
than high, the horizontal diameter between the transverse processes being $15\frac{3}{4}$ inches, and the perpendicular in the middle only $9\frac{1}{2}$ ". Projecting these diameters in lines, the transverse diameter is situate somewhat above the middle of the perpendicular. The articular surfaces for the occipital condyles are together $7\frac{1}{2}$ inches broad and each 5" high.

The three following united vertebræ are figured in fig. 2 from

* I find a very correct description of the whalebones of the European species by Ravin in the 'Annal. des Sciences Naturelles,' 2^e sér. Zool. t. v. p. 266, pl. 11.

behind. Each one has a large transverse process, which is perforated in the middle by a great elliptical opening. In the very strong second vertebra this opening is the smallest, and the horizontal diameter of the opening shorter ($4\frac{1}{2}$ inches) than the outer end of the transverse process ($5\frac{1}{4}$ inches); but in the two others the opening occupies nearly the whole process, surrounded only by a small osseous ring. The upper part, including the vertebral canal, is broader

Fig. 2.

Second, third, and fourth vertebrae of *B. bonaiensis*.

than high; and this canal is of a depressed triangular figure. The arch is very strong and thick on the second vertebrae, and, in each of the three, armed with three small upright spines, of which the middle is the *processus spinosus*. The fifth vertebra of the neck has quite the same form; its lateral process is a closed osseous ring; but the sixth differs by being open in the middle of the under part of this ring, near the enlarged point, and the seventh by having no under part to the ring, but only the upper half circumference with the enlarged point at the end.

In most of these characters the species differs from the European *B. rostrata*, as this has only in some cases the second and third cervical vertebrae united, and open rings on all, after the second, of which open ring the upper part is smaller than the under, and not provided with the enlarged point at the end, which is present in all the cervical vertebrae after the second of my new species.

The small erect spines on the vertebral arch are also wanting in the European species, and the lateral processes are much shorter in comparison with the transverse diameter of the bodies of the vertebrae. As an individual character of my specimen I must remark that the upper parts of the lateral processes of the sixth and seventh cervical vertebrae are united together on the left side in their whole extent, which seems to me a consequence of disease during the

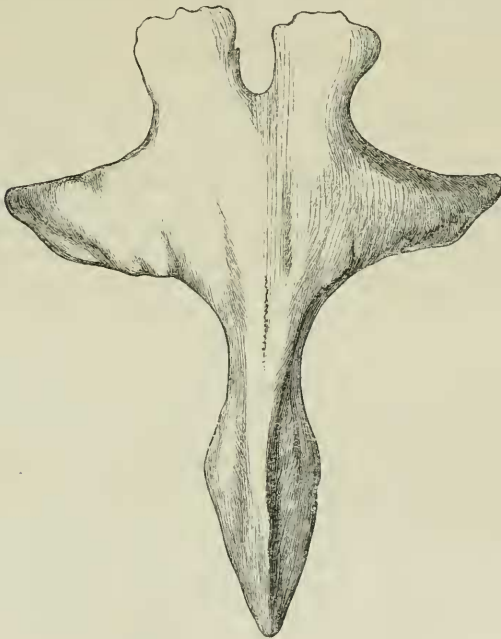
life of the animal; the same circumstance may have also united the first and second dorsal vertebræ, which are also ankylosed to each other at some points of the arch and the upper part of the body. As the animal is a very old one, having no epiphyses separated in the whole skeleton, I must believe that it was wounded when young on the left side of the neck, perhaps by the harpoon of a whaler.

The eleven dorsal vertebræ have the usual form, and increase in size from before backwards rapidly, the body of the first vertebra being only $1\frac{3}{4}$ inch, and the eleventh $5\frac{3}{4}$ inches; they have all long lateral processes, to an excavation on the hinder edge of which are attached the ribs.

The spinous processes increase gradually in height to the middle of the lumbar portion of the vertebral column.

There are eleven pairs of ribs. The first is broader than the others and 2 feet long. The longest is 4 feet in a straight line, and in the middle of the series. The first pair is attached to the sternum, which has a very peculiar form. It is (fig. 3) like a cross, resembling the

Fig. 3.



Sternum of *B. bonaerensis*.

same bone of the European species; but the upper, short branch of the cross is, unlike that of *B. rostrata*, divided into two large parallel lobes. No bone proves more convincingly the distinctness of the

species than the sternum. As my figure gives a clear view of this bone, I will not describe it more, adding only the measurements. The length in the median line is 17 inches, and the transverse diameter in a straight line 13"; the outside is curved downwards and very rough, the inside excavated and smoother.

Of the twelve lumbar vertebræ, the first is 6 inches long, and the last 9 inches; this vertebra is the largest of all. They have higher spinous processes than the dorsals, but shorter and broader lateral processes, this process of the ninth and tenth dorsal vertebræ being the longest of all, *i. e.* 1 foot. The spinous processes of the middle lumbar vertebræ are 17" high; but the lateral processes are only 9" long and 7" broad. They have all thin sharpened outer margins, not an expanded tip for the attachment of the ribs like the dorsals. The tail is composed of nineteen vertebræ, of which the twelve anterior are very strong, but the last six in the axis of the tail-fin extremely small. To the nine anterior caudal vertebræ are attached inferior spinous processes; on the following nine they are wanting. The transverse processes of the first are not perforated. The fifth is the last vertebra with an indication of such a process. The sixth, seventh, and eighth have short spinous processes; but all the others are without either. As far as the thirteenth they have the body perforated. The six last are very small and of a peculiar triangular figure.

The skeleton of the arm-fin is of the usual construction, but has also some peculiarities. The bladebone is rather large, 32 inches broad at the upper margin in a straight line, and 18" high from the glenoid cavity to the same margin. The acromion is 7" long, compressed, and somewhat curved above, with an attenuated end, which is not enlarged as usual in Whales. The coracoid process is, on the contrary, thicker at its end, and rounded like a club, and 4½" long.

The very strong humerus is short, only 11" long; but the forearm-bones are tolerably long, being 23", and the radius somewhat stronger than the ulna, which has a large olecranon like a high crest, of semi-circular figure, which is surrounded by thick and strong cartilage. The carpal bones are seven on each side, all enclosed in thick cartilaginous matter, which united them with the forearm-bones and with the metacarpus of the fin. Two of these seem to be the free lower epiphyses of the radius and ulna, and the remaining five the true carpal bones.

The hand has four fingers, wanting the first or thumb, as usual in the Fin-whales. Each finger has a large metacarpal bone, and the two outer ones two other osseous phalanges; but the largest (second) finger has four phalanges, and the following three. There have been more cartilaginous articulations, but all these are lost. The first phalangeal bone of the second finger is the largest bone of the hand, being 5 inches long. They have no osseous epiphyses on either end, but have been united only by cartilaginous substance.

We have also the small bone of the pelvis, which is 7½ inches long and 1½ inch broad in the middle, and of a lanceolate form, being narrowed at both ends. No vestige of an attachment of another bone

to any part of its surface is visible; and it is the same with the European species, according to the observations of Eschricht and Reinhardt.

The hyoid bone is of the same form as that figured in Cuvier's 'Ossem. Foss.' vol. i. pl. 25. f. 13, being only somewhat larger in the middle, where the two cornua hyoidea are attached. The transverse diameter is 20 inches, and the longitudinal in the middle of one of the two points 7 inches. The cornua have a more curved form than that figured by Cuvier, and are 12 inches long.

Finally I should mention, what I omitted before, that in the cranium is a distinct lachrymal bone on each side in the prolongation of the orbit at the fore end, like that in Cuvier's figures (pl. 26), to which is attached the zygomatic bone, as Cuvier figures the Rorqual of the Cape of Good Hope (fig. 1 of the same plate). The tympanic bone is persistent and firmly united with the cranium; and the vomer rather short, not longer than in the same figures of Cuvier, and divided at the fore end by a longitudinal fissure into two parallel lobes $2\frac{1}{2}$ inches in length.

6. Description of a New Genus of *Spinacidae*, founded upon a Shark obtained at Madeira. By JAMES YATE JOHNSON, C.M.Z.S.

The Shark which forms the subject of the present communication is closely allied to those members of the family *Spinacidae* which constitute the genus *Centrophorus*; but since it possesses a mesial tooth in the lower jaw it cannot be assigned to that genus, and I therefore propose to found upon it a new genus named

MACHEPHILUS.

Body elongate, prismatico-triangular in section; head depressed, not distinct from the body; nostrils on the inferior side of the head; spout-holes large, furnished with valves, and situate on the upper side of the head above the eyes; a deep groove at the commissure of the lips. Scutella (scales) stalked. Two dorsal fins, each supported by a strong spine. No anal fin. The teeth of different form in the two jaws; those of the upper jaw consisting of triangular cusps on subquadrate bases; those of the lower jaw composed of cusps on subquadrate bases, the cusps being more and more inclined backwards as the teeth approach the back of the mouth, thus presenting oblique incisorial edges. A mesial tooth, consisting of an upright equilateral cusp on a quadrate base, in the lower jaw.

MACHEPHILUS DUMERILLI, ♂.

Of a uniform brownish-grey colour. Head rather broad, depressed, PROC. ZOOL. SOC.—1867, No. XLVI.

concave between the eyes and spout-holes; cheeks convex; snout short, rounded in front, flat above and below. Nostrils large, reaching to the sides of the snout. Eye-slit almond-shaped. Spout-holes transversely oval, placed above the eyes. Mouth wide; the jaws slightly but evenly convex; the upper jaw protrusile from beneath the scaly skin. The slit or groove at the commissure advances to the vertical from the middle of the eye, leaving a considerable space between the opposite grooves. The posterior part of the slit is very shallow, and does not extend beyond the vertical from the posterior edge of the spout-holes.

The teeth of the upper jaw are composed of sharp narrow upright conico-compressed cusps on subquadrate bases; and several rows of them are in use at once. In the lower jaw there are two rows of teeth, formed of broad flattened cusps on subquadrate bases, which have a ridge down the middle. The cusps, as the teeth approach the back of the mouth, become more and more inclined backwards, but their apices bend upwards and form an acute point; thus only part of one edge of the cusp presents an incisorial edge, at the middle of the lower jaw, having both its sides in front of the adjacent teeth. It is formed of an upright equilateral cusp with acute edges placed on a quadrate base.

The five branchial openings are large, and are situate in front of the pectoral fin, the hindmost embracing the anterior part of the root of that fin.

All the fins are clothed with scales. The first dorsal fin is nearer to the pectoral fin than to the ventral fins, and has in its front part a strong spine more than half as high as the fin, which is so much worn in the specimen that its shape cannot be accurately stated. The second dorsal fin is rounded in front, where it is higher than the anterior fin. It is also armed with a strong spine (which, however, is not quite so large as the spine of the first dorsal), and it is acuminate behind and prolonged in a direction nearly parallel with the tail. The ventral fins have two-thirds of the total length of the fish in front of them. Their anterior angles are rounded off, their posterior angles prolonged and pointed. The caudal fin is shaped much like that of the true *Centrophori*. The tail bends upwards inside the upper lobe, and the lower lobe is well developed. The upperside of the tail behind the dorsal fin is concave. The lateral line is high up on the side of the body and straight. The claspers are furnished with a slender spine.

The scutella or scales are stalked, and have subrotund laminae continuous with their stalks, each lamina being marked by two lateral and a median crest, which projects behind as an equilateral tooth. The hinder edge of the lamina is minutely serrulate.

The species is named in compliment to Professor Auguste Duméril of the Jardin des Plantes, Paris, the author of a valuable work describing the known genera and species of Sharks.

The dimensions of the single example obtained (which has been added to the collection of the British Museum) are given below.

	inches.
Total length	43 $\frac{1}{2}$
Height under first dorsal	7
Head, width at spout-holes	5 $\frac{3}{8}$
Eye-slit, length	2 $\frac{1}{4}$
——, distance from snout	2 $\frac{7}{8}$
Spout-holes, length	1 $\frac{1}{8}$
Mouth, width=distance from snout	3 $\frac{3}{8}$
Pectorals, width of base	2
——, distance from snout	9 $\frac{1}{4}$
First dorsal, length of base	5 $\frac{3}{4}$
——, vertical height	2 $\frac{1}{8}$
Second dorsal, length of base	3 $\frac{1}{2}$
——, vertical height	2 $\frac{1}{4}$
Ventrals, width of base	1 $\frac{5}{8}$
——, distance from snout	27
Caudal, length	9 $\frac{1}{2}$

7. Description of *Halcrosia afzelii**, a new Crocodile from Sierra Leone, West Africa. By WILHELM LILLJEBORG, Professor of Zoology in the University of Upsala, F.M.Z.S.

Length from the point of the nose to the tip of the tail about 4' (Swedish workmen's measure†, *i. e.* with 12 inches to the foot). Length of the head from the os quadratum 7 $\frac{1}{4}$ "; breadth of the head at the back part 4 $\frac{1}{4}$ "; its length from the posterior extremity of the under jaw 8", from the orbits to the point of the nose 3 $\frac{5}{8}$ "; breadth of the nose over the ninth tooth, the widest part of the upper jaw, 2 $\frac{7}{8}$ ". Length of the lower jaw 2". The head's length in proportion to its breadth marks it as a short broad form; the nose is, however, much narrower than in the *Halcrosia frontata* (Murray)‡, as is evident by the proportion of the breadth above the ninth tooth to the distance between the orbit and the tip of the nose, the former being but about two-thirds of the latter. According to Murray's figure this breadth amounts to three-fourths of the above-mentioned distance. With respect to the form of the nose, it appears to be intermediate between *Halcrosia frontata* and *Crocodilus vulgaris*. The fosse supratemporales are small, and their lower openings very small, situated in front, and directed outwards and forwards. The supratemporal or sincipital plane is somewhat concave in the middle, and the forehead between the orbits destitute of keel.

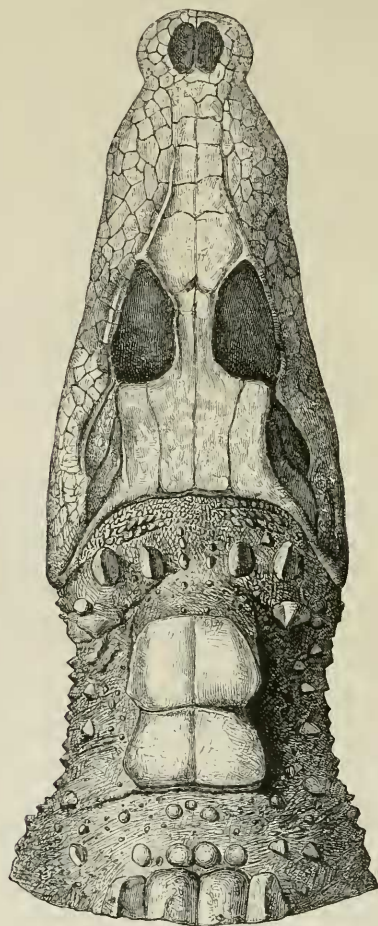
* With this name we call to remembrance the late Professor Adam Afzelius of Upsala, who brought home to Sweden from Sierra Leone this specimen, together with many other interesting specimens of animals and vegetables.

† Swedish feet and (workmen's) inches are reduced to English by multiplying by 0.9741, or dividing by 1.0266.

‡ Gray, P. Z. S. 1862, p. 213.

From the anterior angle of the orbits a tolerably highly raised ridge passes over each of the ossa lacrymalia, and extends somewhat more than a third of the nose's length; and these ridges converge as they approach the tip of the nose. The nasal bones extend so far into

Fig. 1.



Head of *Halcrosia afzelii*.

the cavity of the nostrils as almost entirely to constitute the division between them, and leave only a very small space occupied by cartilage between themselves and the back-turned processes of the intermaxillary bones. The head, when looked at in profile, exhibits almost the same strongly marked concavity over the nose as the

Halcrosia frontata. The edges of the jaws are strongly sinuated; and the upper jaw has on each side a deep hollow, to receive the seventh tooth of the lower jaw, which in this instance is the largest, and its two foremost front teeth do not pass through the intermaxillary bone. The teeth are $\frac{17-17}{15-15}$. The back teeth of the under jaw do not project in between those of the upper jaw, but within them, as in the case of the Alligators.

Fig. 2.

Hind foot of *Halcrosia afzelii*.

Our specimen being imperfect, we have, as regards the feet, the opportunity of examining only one of the hind feet (fig. 2). The web is well developed, but the exterior edge of the foot is not fringed. It has but one row of four somewhat large keeled scales, which do not form any prominent lobe or fringe. The remainder of the outer side of the foot is covered with keeled scales of various sizes.

With regard to the plates of the skin, this genus, as is known, is especially distinguished by the peculiar form of the upper plates of the nape. These have also in this species a characteristically broad form, with almost horizontally outstanding keels, and are particularly large; but there are but two pairs, and a considerable interval separates the posterior from the anterior dorsal plates; they have in the middle of their upper surface a shallow longitudinal groove. The cervical plates are six in number, forming a curved transversal row, and are oval and strongly keeled. The dorsal plates form four continuous longitudinal rows, of which the outermost on each side is distinctly, the innermost indistinctly, keeled; there is, moreover, on each side a couple of imperfect rows, and several scattered plates on the sides of the body. The back and loin have eighteen transversal rows of plates, including the foremost exceedingly small ones. The tail has twelve similar rows between the base and the strongly projecting serrated lobe, or crista. All these plates are as it were sculptured with fine concentric raised lines, as is also the case with the plates of the head and feet. As the end of the tail is missing I am unable to give the number of plates in its crista. The ventral plates are ossified. The colour is indistinct, but seems to have been a very dark brown.

The animal in its general habit closely resembles the Alligators, and was on this account, by the late Professor Thunberg, in the University's collection, named *Lacerta alligator*. The specimen, which is imperfect, was brought from Sierra Leone, West Africa, by the late Professor Adam Afzelius, and was, together with his other collections, presented many years ago to this University's Zoological Museum.

8. Remarks upon the Fabrician species of the Satyride Genus *Mycalesis*; with Descriptions, and Notes on the named varieties. By ARTHUR G. BUTLER, F.Z.S.

The scarcity of figures of the Fabrician insects, and the culpable carelessness noticeable in the descriptions of that author, more especially the bad habit which he had of describing the same species twice under separate names, has made the determination of his species, at all times, a work requiring much time, labour, and patience.

The existence of several types in the Banksian collection, of course, affords most important assistance to the student; but as the labels upon these types have in some cases been transposed, it is at all times necessary to compare the insects carefully with their descriptions.

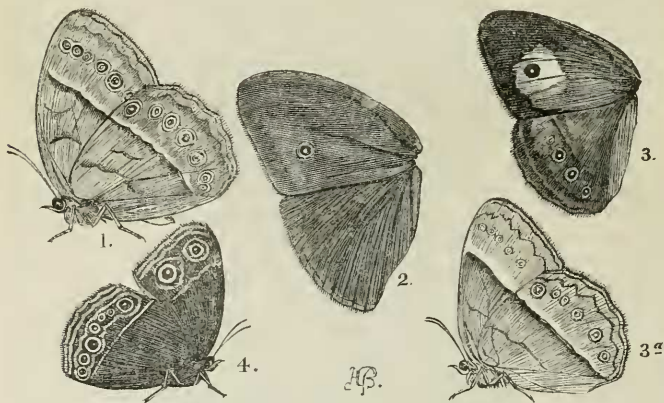


Fig. 1. *Mycalesis sirius*.
2. — *perseus*.

Figs. 3, 3a. *Mycalesis terminus*.
4. — *blasius*.

I have recently been working out the genus *Mycalesis*, and I find that little or no notice has been taken of the Fabrician specimens, the necessary consequence of which has been that several of his species have been referred to genera with which they have no connexion, whilst the insects themselves have been redescribed, and thus

the synonymy of this extensive group of Butterflies has been uselessly increased.

As, by a careful comparison of the types and typical descriptions with the specimens in our collection, I have succeeded in satisfactorily determining several of the above species, I hasten to lay the result of my investigations before the Society.

Sp. 1. MYCALESIS MELUSINA.

Papilio melusina, Fabricius, Ent. Syst. iii. pt. 1. p. 240. n. 750 (1793).

Hab. Sierra Leone.

B.M.

This has been already placed with *P. dorothea* of Cramer, with which it is doubtless identical: it in almost every point agrees with the insect from Old Calabar, described by Mr. Hewitson under the name of *M. raesaces*. I have pointed this out to Mr. Hewitson; and he agrees with me that his species can be nothing more than the Calabar form of the insect from Sierra Leone.

1^a. MYCALESIS MIRIAM.

Papilio miriam, Fabricius, Ent. Syst. iii. pt. 1. p. 242. n. 754 (1793).

Hab. Angola.

B.M.

"*Alis dentatis fuscis subtus cinereis: anticis ocellis duobus, posticis septem. Habitat in Indiis.*"—Ent. Syst.

This only differs from the preceding in being entirely brown on the upperside, and in having the markings of the underside much more distinctly visible.

Sp. 2. MYCALESIS PERSEUS. (Fig. 2, p. 718.)

**Papilio perseus*, Fabricius, Syst. Ent. p. 488. n. 199 (1775).

Papilio tabitha, Fabr. Ent. Syst. iii. pt. 1. p. 243. n. 756 (1793).

Hab. North India.

B.M.

"*Alæ anticæ fuscæ, mox immaculatæ, mox ocello parvo, pupilla alba ante apicem. Posticæ fuscæ, immaculatæ. Subtus omnes basi fuscæ, apice dilutiores, anticis punctis tribus, posticis septem albis subocellaribus.*"—Syst. Ent.

"*Alæ supra omnes nigræ anticis ocello parvo atro, pupilla alba. Subtus pallidiores striga e punctis ocellaribus minutissimis pupilla alba.*"—Ent. Syst.

This is of course only another of the many varieties of *M. otreæ* of Cramer: the underside of the wings is represented by Donovan in his 'Insects of Asia;' but the colouring is so extravagant that the figure rather hinders than aids the determination of the species.

2^a. MYCALESIS CLERIMON.

Papilio clerimon, Fabricius, Ent. Syst. iii. pt. 1. p. 217. n. 678 (1793).

Hab. —?

* The type is in the Banksian collection.

This appears to be another variety of *otrea*, but it does not quite agree with any specimens that I have seen.

In the 'Genera of Diurnal Lepidoptera,' *M. tabitha* is placed in the genus *Satyrus* (p. 391. n. 34); *M. clerimon*, with a query, in the genus *Lasiommata* (p. 387. n. 16).

Sp. 3. MYCALESIS BLASIUS. (Fig. 4, p. 718.)

Papilio blasius, Fabr. Ent. Syst. Suppl. v. p. 426. n. 488, 489 (1798).

Hab. East Indies (*Fabr.*); Philippines.

B.M.

"*Alæ omnes integerrimæ, supra fuscæ, immaculatæ: subtus vix pallidiores striga media obliqua, alba. Anticæ pone strigam ocellis tribus atris iride flavescente pupillaque alba, intermedio minuto. Ocelli annulo communi reniformi includuntur. Margo strigosus. Posticæ ocellis septem inæqualibus strigis duabus undatis utrinque coeuntibus cinereis inclusis. Margo strigosus.*"

—Ent. Syst.

This seems to be identical with the *M. samba* of Mr. Moore's 'Catalogue,' p. 233. n. 498; it differs from *lalassis*, Hew., in having smaller and less distinct ocelli, and not so many in the front wings; it is also rather smaller.

Sp. 4. MYCALESIS MEDUS.

Papilio medus, Fabricius, Syst. Ent. p. 488. n. 198 (1775).

Hab. Cape of Good Hope (*Fabricius*); Borneo.

B.M.

Fabricius has made a mistake as to the locality of this species; it is evidently identical with *P. doris* of Cramer; the latter is said to be from China, and is only a variety of *M. hesione*.

Sp. 5. MYCALESIS MARTIUS*.

Papilio martius, Fabricius, Ent. Syst. iii. pt. 1. p. 219. n. 686 (1793).

Hab. Java.

B.M.

"*Alæ omnes supra nigræ, immaculatæ, subtus itidem nigræ margine pallidiore et in hoc margine alæ anticæ ocelli quatuor, 2. 4. minutissimi, posticæ ocellis septem tertio majori.*"—Ent. Syst.

This species is closely allied to *M. nala* of Felder, the *mamerta* of Moore's 'Catalogue;' it is, however, slightly smaller, and differs in the width of the margin and the number and relative size of the ocelli.

Sp. 6. MYCALESIS TERMINUS. (Figs. 3, 3a, p. 718.)

†*Papilio terminus*, Fabricius, Ent. Syst. iii. pt. 1. p. 220. n. 687 (1793).

Hab. New Holland.

B.M.

* Felder has recently described and figured a variety of this species, only differing in the number of the ocelli of the front wings, as *M. moorei*, Feld.

† The type is in the Banksian collection.

This species has been figured by Donovan in his 'Insects of New Holland,' pl. 28. f. 4; however, I found it in the collection as the *remulia* of Godart, and confounded with the *remulia* of Cramer, from which it is very distinct.

There are two forms of *terminus*, the one having small and nearly regular ocelli (as in the type), the latter with ocelli varying in size as in *remulia*; but in both forms the undulating marginal lines and the subbasal line of the underside are very conspicuous. We have *remulia* from North Ceram.

Sp. 7. MYCALESIS SIRIUS. (Fig. 1, p. 718.)

**Papilio sirius*, Fabricius, Syst. Ent. p. 488. n. 201 (1775).

Hab. New Holland.

B.M.

"*Alæ anticæ obscure rufæ, apice fuscescentes, ocellis duobus ferrugineis, iride fusca, annulo atro cineta pupillaque alba; subtus glaucæ, arcubus duobus strigaeque ferrugineis, apice obscuriores, ocellis sex, quinto majori. Posticæ obscure rufæ, margine fusco, strigis obscurioribus. Ante marginem ocelli quatuor, intermediis majoribus; subtus basi glaucæ arcubus duobus strigaeque, medio ferrugineis, apice obscurioribus, ocellis septem, ultimo ad angulum ani minutissimo.*"—Syst. Ent.

This is a common and very variable Australian species; the specimens chiefly differ in the number of their ocelli, though the females are sometimes remarkable for having the bands of the underside margined with yellow. *Mycalesis daidis*, Hew., from North Ceram, and *manipa* of Boisduval are varieties of this insect, differing in the number of ocelli alone.

7^a. MYCALESIS ZACHÆUS.

Papilio zachæus, Fabricius, Ent. Syst. iii. pt. 1. p. 217. n. 679 (1793).

Hab. —? (*Fabr.*); Australia.

♂ ♀, B.M.

"*Alæ omnes supra fuscae ocellis duobus pupilla alba. In posticis interdum adhuc minutus ad angulum ani, subtus itidem fuscae, anticis ocellis quatuor, posticis sex, omnibus pupilla alba.*"—

Ent. Syst.

This description exactly agrees with a slight variety of the preceding, in the National Collection.

Professor Westwood has placed *M. sirius* in the genus *Cænonympha* (p. 398. n. 26); *zachæus* is placed with a query in the genus *Lasionmata* (p. 387. n. 17).

Sp. 8. MYCALESIS NARCISSUS.

Papilio narcissus, Fabricius, Ent. Syst. Suppl. v. p. 428. n. 672, 673 (1798).

Hab. Cape of Good Hope (*Fabricius*); Mauritius.

B.M.

This insect has been carefully described by Boisduval; on the upperside it is much like *M. ita* of Felder.

* In the Banksian collection.

9. On some New Species of Australian Land-Shells. By
JAMES C. COX, M.D., F.R.C.S. Edin., Secretary of the
Entomological Society of New South Wales.

Since the issue (in 1864) of a 'Catalogue of Australian Land-Shells' in my collection, in which many supposed new species were described, I have from time to time transmitted, for publication in the 'Proceedings' of the Society, descriptions of such others as appeared to me to be novelties; and I now send a further contribution to the same effect. I mention that a work which I am now preparing for the press, in which all the Australian Land-Shells known to me will be described (in English) and represented by coloured plates, will, I trust, be published before any considerable number of new shells can have come before me, even supported as I have been and still am by the contributions of collectors in all the Australian colonies. However, by next mail I hope to be able to send descriptions of some more undescribed species.

1. *HELIX LAMPROIDES*, mihi.

II. *testa umbilicata, convexo-depressa, tenui, conferte et irregulariter costato-striata, supra vix nitida, infra nitidiore, corneorufescente, subtus pallidiore; spira parvula, convexiuscula, obtusa; anfr. 4, celeriter accrescentibus, ultimo non descendente, supra depresso, infra convexo, obtuse angulato; apertura obliqua, rotundato-lunata; peristomate simplici, tenui, marginibus conniventibus, dextro recto, antice angulato, columellari arcuato, non dilatato, nec reflexo.*

Diam. maj. 0·57, min. 0·50, alt. 0·22 unc.

Hab. North-western coast of Tasmania.

Closely allied to *H. lamprea*, Pfr., but more coarsely sculptured and wanting the extreme polish of that species, besides being obtusely carinated, and having the aperture angular externally.

2. *HELIX HAMILTONI*, mihi.

II. *testa umbilicata, subdiscoidea, convexo-depressa, tenui, conferte subarcuatim costulata, interstitiis tenuissime filosis, lineis minutissimis spiralibus cæteras decussantibus, faciem (sub lente) lineato-granulatam exhibente, haud nitida, pallide rufescente-cornea; spira parva, vix prominente, interdum planata, sutura impressa; anfr. 5, celeriter accrescentibus, planato-convexiusculis, ultimo subinflato, rotundo-convexo, non antice descendente, ad os supra modice planato, basi striis minoribus munito; umbilico perspectivo, fere $\frac{1}{5}$ diametri æquante; apertura diagonali, ovato-lunari; peristomate simplici, tenui, recto, marginibus conniventibus, columellari supra modice dilatato et reflexo.*

Diam. maj. 0·53, min. 0·45, alt. 0·20 unc.

Hab. Mount Wellington, Macquarie Harbour, and north-eastern coast of Tasmania.

A small dark variety from the last-mentioned locality has the de-
 cussating striæ nearly obsolete. This species may be associated with
H. bombycina, Pfr., although not very closely allied to it.

3. *HELIX DIEMENENSIS*, mihi.

*H. testa umbilicata, depresso-orbiculari, discoidea, tenui, trans-
 lucida, costulis perplurimis prominulis subarcuatis munita, non
 nitente, sordide lutescente, fasciis plurimis pallide rufis ra-
 diatim ornata; spira parva, vix prominente, sutura mediocri;
 anfr. $4\frac{1}{2}$, lente accrescentibus, convexiusculis, ultimo regulariter
 rotundo-convexo, non descendente; umbilico $\frac{1}{3}$ diametri æquante;
 apertura obliqua, lunata; peristomate tenui, recto.*

Diam. maj. 0·37, min. 0·33, alt. 0·14 unc.

Hab. Tasmania.

The two specimens in my collection are both imperfect in the
 mouth, so that I cannot describe the upper part of the columella.

4. *HELIX WELLINGTONENSIS*, mihi.

*H. testa umbilicata, depresso-orbiculari, subdiscoidea, tenui, cos-
 tulis filosis subarcuatim radiantibus munita, sæpe usque ad
 umbilicum extendentibus, non nitente, vitreo-albo ad sordide
 luteum variante; spira parva, vix elevata; anfr. 4, lente ac-
 crescentibus, modice convexis, ultimo prominente, convexo, non
 descendente; umbilico perspectivo, $\frac{1}{3}$ diametri æquante; aper-
 tura modice obliqua, lunata; peristomate simplici, tenui,
 recto, marginibus conniventibus, columellari non dilatato, nec
 reflexo.*

Diam. maj. 0·27, min. 0·23, alt. 0·14 unc.

Hab. Mount Wellington, Tasmania.

Closely allied to *H. diemenensis*, but with fewer and more thread-
 like ribs, besides differing in other respects. This shell and *H. ha-
 miltoni* were both presented to me while in Tasmania with the spe-
 cific names now given (by whom I know not) attached; but I have
 no reason to suppose that descriptions of them have ever been pub-
 lished.

5. *HELIX ALBANENSIS*, mihi.

*H. testa umbilicata, depresso-convexa, arcuatim acute flexuoso-
 costata, solidiuscula, haud nitida, flavescens, superne fasciis
 plurimis rubro-fuscis brevibus radiantibus ornata; spira modice
 conoidea, obtusa, sutura impressa; anfractibus 5, lente accres-
 centibus, subconvexis, ultimo rotundato, ad os subinflato; um-
 bilico perspectivo, $\frac{1}{3}$ diametri occupante; apertura rotundato-
 lunata, modice obliqua; peristomate tenui, simplici, marginibus
 conniventibus, callo tenui junctis.*

Diam. maj. 0·20, min. 0·18, alt. 0·12 unc.

Hab. Port Albany, Western Australia (*Masters*).

This would come under the subgenus *Discus*, along with *H.
 cygnea*, Bens., and *H. sublesta*, Bens., of the same colony, but is

not very closely allied to either. The red markings are very characteristic.

6. *HELIX PENOLENSIS*, mihi.

H. testa umbilicata, subgloboso-depressa, tenuiuscula, striatula, pallide cornea, nitidiuscula; spira late et obtuse conica; anfr. 4, planato-convexis, ultimo obtuse carinato, non descendente, subtus convexiore; apertura angulato-lunari; peristomate simplici, recto, margine dextro vix curvato, ad carinam angulato, tum arcuato, fere semicirculum formante, columellari superne calloso, breviter dilatato, et paululum reflexo, umbilicum parvum semitegente.

Diam. maj. 0·15, min. 0·13, alt. 0·08 unc.

Hab. Penola, South Australia (*Rev. J. E. Terrison Woods*).

A rather dull, horny, broadly semiconical species, allied to *H. turriculata*, mihi.

7. *HELIX TURRICULATA*, mihi.

H. testa minute umbilicata, semigloboso-conoidea, pallide corneo-vitrea, nitidiuscula, tenuissima, undique tenuiter striatula; spira conica, obtusa; anfr. 6, lente accrescentibus, convexiusculis, ultimo carinato, non descendente, basi leviter declivi, striatulo ut supra, sed nitidiore; apertura modice obliqua, angulato-lunata; peristomate simplici, tenui, antice leviter angulato, margine columellari supra modice dilatato et fornicatim expanso.

Diam. maj. 0·15, min. 0·13, alt. 0·10 unc.

Hab. Miriam Vale, Port Curtis, Queensland.

A delicate, glassy, conical species, the very regular spire of which is thrice as high as the base. It may be regarded as belonging to the section *Conulus*, and is nearly allied to the less trochiform and hyaline, but more coarsely sculptured *H. umbraculorum*, Cox.

8. *HELIX AVIDORUM*, mihi.

H. testa profunde umbilicata, depresso-globosa, tenui, parum nitente, radiatim rugoso-striata, et (sub lente) subtilissime granulata, corneo-lutescente; spira parva, late depressa; apice obtusa, sutura impressa; anfr. 4½, convexis, ultimo peramplo, rotundato, tumido, basi pallidiore et leviore; apertura lunato-circulari, peristomate tenui, recto, reflexo, marginibus conniventibus, columellari basi modice dilatato, umbilici semissem obtegente.

Diam. maj. 0·55, min. 0·45, alt. 0·30 unc.

Hab. Clarence River, New South Wales (under logs in open iron-bark ranges, burrowing in wet weather) (*MacGillivray*); Brisbane, Queensland (*Masters*).

9. *HELIX MARCESCENS*, mihi.

H. testa anguste et profunde umbilicata, depresso-orbiculari, tenui, translucente, nitidiuscula, levissime rugoso-striata et (sub lente)

subtilissime granulata, corneo-lutescente; spira convexa, obtusa, sutura mediocri, tenuiter rufo tæniolata; anfr. 5, lente accrescentibus, convexiusculis, ultimo rotundo-convexo; apertura lunari-rotundata; peristomate recto, tenui, marginibus subconniventibus, columellari supra dilatato et fornicatim reflexo.

Diam. maj. 0·63, min. 0·57, alt. 0·30 unc.

Hab. Clarence River, about South Grafton (under bark and logs) (MacGillivray).

A thin horny semitransparent shell, like a starved miniature *H. grayi*, Pfr., and approaching next to *H. avidorum*, mihi, a much more globose shell with an impressed suture. The reddish streak along the suture is not always present.

10. *HELIX PACHYSTYLOIDES*, mihi.

H. testa umbilicata, globosa, solidula vel tenui, nitida, corneo-lutescente, striis incrementi levibus, rugatis, confertissime rugis irregularibus decussata; spira brevi, obtusa, sutura crenulata; anfr. 5, convexis, celeriter accrescentibus, ultimo permagno, inflato; apertura fere diagonali, rotundato-lunata; peristomate extus flavo, intus pallide carneo (interdum ulbido), recto, tenuiter expanso, marginibus subconniventibus et callo tenui junctis, basali expansiore, columellari supra dilatato, intus subcalloso, externe umbilicum profundum semiocculante.

Diam. maj. 1·20, min. 1, alt. 0·85 unc.

Hab. Cape York (*Damel*).

This varies considerably in solidity, being sometimes even a delicate thin and horny shell, then most nearly allied to the very small but exumbilicated variety of *H. pachystyla*.

11. *HELIX MUCOSA*, mihi.

H. testa umbilicata, depresso-orbiculari, subdiscoidea, irregulariter et conferte rugoso-striata, solidiuscula, oleoso-micante; spira latissime conoidea, apice submersa; anfr. 4½ lente accrescentibus, convexiusculis, ultimo subito antice deflexo, obsolete carinato, basi convexo, rugoso-strigato ut supra, sed levius; umbilico perspectivo, fere ⅓ diametri æquante; apertura rotundo-lunari; peristomate simplici, recto, marginibus subconniventibus, columellari supra valde expanso et reflexo.

Diam. maj. 0·30, min. 0·25, alt. 0·14 unc.

Hab. Clarence River (MacGillivray).

Belonging to the section *Discus*, but not closely approaching any species known to me. I hope the name *mucosa* will stand, although there is already a *mucida*.

12. *HELIX PEXA*, mihi.

H. testa umbilicata, depressa, fere discoidea, tenui, translucente, regulariter et conferte arcuato-costata, costis apparentibus ut binis coalescentibus, interstitiis non (sub lente) striatis, pallide lutescenti-cornea; spiru plana, sutura mediocri; anfr. 4, con-

vexis, ultimo angusto, rotundato, basi subnitido, costulis in umbilicum perspectivum et $\frac{1}{3}$ diametri æquantem descendentibus; apertura fere diagonali, lunari; peristomate simplici, tenui.

Diam. maj. 0·08, min. 0·07, alt. 0·04 unc.

Hab. Greystanes, New South Wales (Cox).

Easily distinguished from the nearly allied *H. cochlidium*, Cox, by the difference in colour, and the fineness of the minute riblets, which are also much more numerous than in its white plicately-ribbed ally.

10. Notes on the Specimens of *Calyptræidæ* in Mr. Cuming's Collection. By Dr. J. E. GRAY, F.R.S., V.P.Z.S., F.L.S., &c.

Mrs. Gray having kindly undertaken to place some of the shells of the late Mr. Cuming's collection on tablets, the specimens of certain families have come under my supervision, and I have been induced to make some observations that I thought might tend to the better understanding of the species. I herewith send my notes on the shells of the family *Calyptræidæ*, and this paper may be followed by some others of a similar character.

I shall preface these notes by some observations on the collection itself.

I certainly should have considered the following observations unnecessary if most exaggerated statements had not been published respecting the collection, which are likely to mislead the public—such, for example, as that each specimen had not only its name and its special locality attached to it, but also the depth in the ocean at which it was found, and that the specimens are in all instances the actual types of the species from which the descriptions have been taken. As this is not the case, it is necessary that some account of the collection as it was received by the British Museum should be given, in order that it may be properly understood by the scientific conchologists who may hereafter consult it. I have not the least intention by the following remarks to depreciate the value of Mr. Cuming's labours as a collector, or of his collection; for every conchologist, both scientific and amateur, is very greatly indebted to him for having collected one of the largest and most perfect collections of shells ever brought together; for he not only collected extensively himself, but he excited others to collect, and he left no stone unturned to obtain from other collections in all countries such specimens as he wanted, or from which, as types, species had been described; and he also, in the most free and liberal manner, opened the collection to the use of such conchologists and iconographers as would fall into his views as to the describing and naming of species.

When I first saw the collection, fifteen or sixteen years ago, as may be seen by my report to the Trustees of the British Museum,

which is published in some of the Parliamentary Papers relative to the Museum, the collection was without any names or habitats to the species. The names have been added since Mr. Cuming's recovery, and gummed to the mouth of one of the specimens of each preserved species. These names were not affixed by the original describers and figurers of the species, but by two well-known conchologists; and as they must be considered to rest on identification by the latter and not by the original describers, this rather detracts from their authenticity as absolute types of the species described. It is to be regretted that when these names were attached the special habitats of the specimens were not also marked on them.

I am informed that as soon as any specimens were described Mr. Cuming was in the habit of destroying the habitats sent with them, as he said they could be discovered by looking at the work in which they were described. This is certainly a very inconvenient and roundabout way of arriving at the information required: if the species was procured from two or more localities, one is not able to discover which specimen belonged to each special locality.

In many of the specimens, especially those that have not yet been determined or named, the habitat, written on a small paper label, is stuffed into the mouth of the shell.

As yet I have not observed any indication of the depths in the ocean whence the specimens were obtained. Indeed it was only the specimens which Mr. Cuming or a few other collectors themselves dredged to which such an addition could be made; and I suppose that Mr. Cuming would also say that this could be obtained from the work in which the species are described. But here, again, the same uncertainty prevails; which are the specimens that were obtained at the depth indicated? Perhaps all those that were referred to when first described have been replaced by other and better specimens obtained at a very different depth; for shells vary in size and colour according to the depths at which they may have happened to live.

It was of necessity impossible that Mr. Cuming could have ascertained the depth at which the shells lived that he obtained from the various collections he selected from, or from other dealers*.

* Indeed I am not willing to pay so much regard to the depth at which species are said to have been obtained as some geologists appear to do, except when the specimens are obtained at some special dredging. My faith was shaken by the following fact:—A collection of shells was offered to me for sale, at the time that geologists were interested in the depth at which mollusca live, which I carefully examined; but as it contained many duplicates I declined it, and it was purchased by a respectable dealer. And what was my astonishment, when the collection was offered to me to select from, to find that each species was marked with the depth at which it was obtained, for which there was not the slightest authority; but the subject of depth was exciting interest at the time, and its being attached to the specimen was supposed to give them an additional value; and I regret to say I have seen these pretended depths quoted in a geological work as if they were true. Persons who have theories to propose or support are often not sufficiently alive to the great necessity of examining the authority of the statements which they receive and quote as facts, or the readiness with which persons, when money is to be made by the subject, are willing to stretch a point to suit their purpose.

Though, in the vast majority of cases, the shells more recently named are to be regarded as the type specimens of the species described and figured from Mr. Cuming's collection, unfortunately, from Mr. Cuming's habit of replacing shells in his cabinet by better specimens when they occurred, there is a certain amount of uncertainty as to these shells being the types of the species described, the accuracy of the determination resting in such cases on the accuracy of Mr. Cuming's determination of their identity with the shells replaced; but there is no doubt that in the distinction of species and varieties Mr. Cuming was very acute and is to be generally depended on.

There is also another source of uncertainty. Mr. Cuming was in the habit of sending to Dr. Pfeiffer, Reeve, Sowerby, and other describers and figurers of the species certain specimens from his duplicates marked with the same number as that attached to his own specimens; and the determination of the species depended on the accuracy with which these numbers were reported. I have observed a few undoubted mistakes arising from this system, and therefore believe that there may be others, though probably the number is not large; but these show the necessity of depending in all these cases on the shell named agreeing with the description, rather than on the fact that the specimens are so named in the collection.

A very large number of species in the collection have been separated on very slight characters, or on the slightest variation of form, state, and colour. This has greatly arisen from the description and figuring of shells lately made known chiefly falling into the hands of dealers, like Mr. Reeve and Mr. Sowerby, or of persons employed by dealers, who select for their purpose those who are ready to fall into their views and make as many new species as possible; and the dealers are ready to repay such work with specimens to increase the describer's collection, or in other ways.

A shell with a new name is much more valuable in a pecuniary point of view than one with an old and well-known name.

The value dealers attach to new names is proved by an incident that occurred to myself a few days ago, when a dealer offered me a new *Volute* for ten guineas. I said it was not new, only a slight variety of a well-known species. At length he admitted that he had nine specimens of the *Volute*, and ended by offering to present me with the best of the series if I would describe it as a new species! I am told that at length he found a person to fall into his views, and sold all his specimens at or above the price first mentioned. A short time ago a gentleman was induced to purchase a *Volute* at a high price, on the understanding that if he purchased it it would be described, figured, and named after him. This was done, though the shell is only a slight variety of a well-known not uncommon South Australian species. Fortunately the description was printed only on a flyleaf with the plate, and it is not likely to be preserved.

The paying for the description of species of animals is no new source of trade, for it is recorded that John Reinhold Foster was paid threepence a species for describing new British insects for a scientific zoologist; but dealers can now afford to pay better, as is

shown by the offer that was made to me respecting the new *Volute*; and private collections have been much enriched by such labours.

No one knew better than Mr. Cuming the value of a new name to his specimens, as shown by his enmity to any one who doubted the novelty of the species described. He would not allow me to see his collection for many years after his return from South America, because I had pointed out to him at one of the meetings of this Society that some of the shells which Messrs. Sowerby and Broderip had described as new were well-known species, and well figured by Chemnitz. Indeed I was not allowed to see any part of his collection until it was first offered to the British Museum for sale, during his illness about sixteen years ago.

Since that period Mr. Cuming refused a well-known conchologist, who had previously described several shells from his cabinet, any further use of his collection, because he refused to admit that certain specimens which he sent to him to be described were new to science, or different from species already described.

The system that Mr. Cuming adopted of selecting three specimens of each variety or species most alike tended to prevent the number of nominal or presumed species from being observed during a casual examination of the collection, as it excluded those specimens which showed the transition from one variety to another which occurs in any given species—more especially as the species were not arranged in the drawers so that the most allied or presumed species were near to each other, but, on the contrary, the two or more variations of the same species were often placed as species in distant parts of the series.

The fact of a naturalist having the power of merely adding his name after the name of an animal or plant described has been supposed to have influenced many in attempting to establish species, or in altering the names of old species on very slight grounds; but if we add to this little vanity the greater inducement of an increase in the value of the specimens themselves and the collection in which they are contained, or of increasing the sale of the book in which they are described and figured, or, further, if a naturalist is to be paid so much per species for all the species he can describe from a collection, it is not difficult to believe, under these various circumstances, that the number of the species in such a collection are very needlessly increased.

This has caused so many nominal species to be created by collectors of ferns and other plants and by nurserymen; but such names are rarely regarded as of any authority by scientific botanists.

I have had the shells of the Cumingian collection placed on tablets so that they may be arranged in the same series as the other shells in the British Museum; but each tablet is marked in such a manner that it may be at once distinguished from the rest of the collection, so that there can be no doubt about which are the types or the presumed types of the species described from the collection. I feared that, if the shells were not placed on tablets, the specimens of the same species might be separated from their allies and mixed with

those of other species, and thus the identity of the nomenclature might be destroyed or rendered doubtful.

It is to be hoped that some day this magnificent collection of shells in the British Museum may be studied scientifically, and all their nominal and dealers' species be reduced to synonyms, and eventually allowed to drop out of the catalogue, to which the greater part of them ought never to have been admitted. To attempt to do this to some extent in certain families is the one of the objects of this paper.

I have not attempted in these notes to give a general synonymy of the species; but I have only added after the name of each species a list of the names and their authors that are attached to the specimens of the species described in Mr. Cuming's collection, which are to be presumed to be the types of the species described or figured under these names by the author quoted. In some instances the state of the specimen named by the author renders the determination uncertain; then I have added a mark of doubt before the names.

At the commencement of this century shells were generally arranged according to the Linnean system, and Dillwyn's 'Species of Shells' was one of the best works published, and Wood's 'Illustrated Catalogue' was a useful and cheap collection of figures; and the system suited very well for the small number of species then known.

Some of the older collectors preferred to use Humphrey's catalogue, in which many modern genera were sketched out, rather than the heterogeneous collection of species that were crowded in the Linnean genera.

Whenever a person had a large collection to arrange he found, like Humphrey, that the shells fell into natural groups that were recognized by the public, who had given them vernacular names.

Thus Lichtenstein in Berlin, Schumacher in Copenhagen, and Lamarck in Paris, each having a large collection to arrange, proposed new groups of species, or genera, and a new arrangement of the genera.

Lamarck, who had been educated as a botanist, set to work to describe the species in the genera which he proposed; and that gave a preponderance to his system.

The use of the Lamarckian system was first introduced into England by my predecessor, Mr. Children, who arranged the shells in the British Museum on that system, and published a translation of Lamarck's 'Genera,' illustrated with a figure of each. Sowerby and Couch published similar works. And more lately the late Mr. Woodward, who seems to have been disturbed at the rapid progress that the knowledge of the animals and shells were making in this country, published his manual, which is written chiefly from a palæontologist's point of view, trying to stem the current; and the manner in which his work has been received, and is still spoken of, is a proof that he well understood the calibre of the collectors both of recent and fossil shells.

When the collection of shells was arranged in the eastern gallery of the British Museum, which had been built for the National Gallery,

then used for the mineral collections, and at length given up to the zoological collections in 1840, I arranged the species in what appeared to me natural groups, and took care to find out the names that previous writers had given to those groups, and gave the characters of the groups and genera in a 'Synopsis' which was sold in the Hall for a shilling. This proceeding at first excited the anger of the persons who had adopted the Lamarckian system, some of whom had a vested interest in works written on that system. Knowing but little of the history of the science, they persisted in believing that all the groups were creations of my own, and denounced me as the manufacturer of an immense number of useless genera. Thus in Sowerby's 'Manual of Conchology' there are numbers of genera referred to me which were formed when I was a child, or even before I was born, and which often are only quoted to be objected to. Yet that manual is a very useful work for any one commencing the study of conchology, as it contains a very good series of figures of many more genera than are to be found in any other English work on the subject.

Observing the ignorance that generally existed on the subject, I compiled a list of genera of recent shells, giving the type of each genus. This was published in the 'Proceedings' of this Society for 1847, and contained in a few pages a condensed account of the labours of most conchologists that had written before that date. This showed how many minds had been occupied with the arrangement of shells,—and also that there were 810 well established genera, many having several names, and that only a very small proportion of them had been separated or named by myself. About the same time Mrs. Gray published, for the use of students, etchings of the animals of shells which she had been collecting for my use from various sources.

The publication of these two works, and the almost simultaneous appearance of a work 'On the Synonyma of the Genera of Mollusca' by Hermannsen, gave a great impulse to this study both in this country and the continent.

Dr. Philippi, during his voyage to Chili, compiled a 'Manual of Mollusca,' chiefly based on my 'List of Genera.'

Then the Messrs. Adams commenced a work on the 'Genera of Mollusca,' based on the same list, and on the collection arranged according to it in the British Museum. And more lately, Dr. Chenu seems to have felt that the time had arrived when the French conchologists might be inclined to progress beyond the system proposed by Lamarck, and published a 'Manuel de Conchyliologie,' in 2 vols. 8vo, illustrated with figures of several thousand species. This work is based on my 'List of Genera,' and on the 'Genera' of Messrs. Adams, and is certainly one of the cheapest and most useful manuals for the use of the shell-collector and malacologist that have yet been compiled.

The collection of shells exhibited in the British Museum first showed to the conchologist and the palæontologist the advantage of the more scientific arrangement of the mollusca and their shells into

smaller groups, and according to the structure of the mollusca and their teeth and anatomy, the opercula, and the shells.

The dealers were at length convinced (as Humphrey had been many years before) that the use of a larger number of genera extended their trade, as it produced a crop of customers (besides those who merely bought shells for their beauty or variety) who purchased the less conspicuous shells for the purpose of obtaining one or more examples of each genus; and the general students were gradually induced to adopt the improvement.

The students of fossil shells seem inclined to lag behind the knowledge of the day. They have some excuse, as fossil shells do not afford them all the means of study to be obtained from recent species; but they might do much more than they have done, and they never can derive all the advantages in geology that the study of the fossil mollusca can afford them until they study their shells with the same attention as has been applied to the recent species, and revise the heterogeneous genera into which they are now grouped. Mr. Searles Wood, long ago, set an example of the right course to be pursued in his paper "On the Crag Fossils;" but few have followed him. I think that the faith they place in Woodward's 'Manual' is one of the causes of their want of progress.

The iconographers, such as Lovell Reeve and Mr. Sowerby, have published illustrated monographs of many genera of shells on the modern system; but unfortunately they do not seem to think it is enough to figure each species, but they figure even slight varieties under the name of species. This has rendered their works so expensive that they are only to be regarded as works of luxury for the libraries of the rich; while the number of the varieties they figure, and the want of system in the arrangement of the species, render them very difficult to use by the scientific conchologist. You may almost buy a good collection of shells for the price of these works; and every one would learn more from the shells themselves than from works on them of such an unscientific character.

Fam. CALYPTRÆIDÆ.

The shells of *Calyptræidæ* are peculiar as being spiral shells which have the edge of the mouth so expanded behind as to cover the hinder part of the foot of the animal. The front side of the last whorls of the shell, which lies on the upper surface of the foot, being protected from external injury by this extension of the margin of the mouth of the shell, is thin and polished externally, like the rest of the inner surface of the cavity of the shell, of which it seems to form a part.

When we have observed the rationale of the structure, the difference between the two families *Calyptræidæ* and *Capulidæ*, which have animals of a very similar structure, is easily understood.

In *Capulidæ* the shell is a very short cone, with a large open sub-circular mouth and an incomplete edge; it has the shell attached to the body of the animal by an adductor muscle near the hinder

edge of the aperture, like most shells of the kind with a very large open mouth—this muscle, of a very large size and extent, leaving an impression of a horseshoe-shape, as is also the case with *Patella* and other shells of the short conical form.

In the *Calyptræidæ*, on the contrary, the adductor muscle, which attaches the animal to the shell, is affixed to the inner surface of the outer lip of the shell, near the margin, as in other spiral shells—that is to say, those that are formed of an elongated shelly cone, spirally twisted round an imaginary axis.

This character is constant, though the shells in the different genera assume such different forms and are sometimes so flat as to be spiral only in name; and it is the adductor muscle that is attached in the same situation, though the outer lip may be in the form of a shelly plate or of a large cup attached to one of the sides of the simple conical cavity of the conical shell, which has only a very minute spiral nucleus, showing that the animal, which when adult forms a conical *Patella*-like shell, had a spiral shell on its back with a moderate-sized mouth when it was first hatched.

The structure of the shells is not usually understood. The front of the last whorl is rudimentary in the entire family. It is most developed and most nearly in the usual form in the genus *Trochita*, and is in a much more rudimentary condition in *Crucibulum* and *Calyptra*. In the genus *Mitrella* the pillar-lip is reflected and soldered on itself, as in most shells with an imperforated axis; but the cavity beneath the reflexed portion in the different species and groups is gradually enlarged, until the shell has what in other shells is called an umbilicated axis. In *Dispotæa* and *Crucibulum* the cup is a very largely dilated umbilicus, surrounded by a very rudimentary front of the whorl. Anomalous as the form of the Cup-and-Saucer Limpet appears, the study of the series shows that it is only an easily understood modification of the usual form of shells.

The structure of *Ergæa* is most peculiar. I cannot call to mind any shell showing the same peculiarities. The front of the whorls is as rudimentary as in *Dispotæa* and *Crypta*; as in the genus *Galerus* there is a small compressed perforation extending up to the apex of the cavity; but this perforation, instead of being on the edge of a twisted central column as in that genus, is on the surface of a transverse plate. This plate somewhat resembles the front of the whorl of the genus *Crypta*; but in that genus the aperture and the front of the whorl are as wide as the shell, and the axis of the shell is marginal, and not marked externally.

Comparing the structure of *Ergæa* with that of *Galerus*, I believe that it chiefly differs from the latter genus in that the front of the inner lip, after being reflexed over the imaginary axis of the shell as in *Galerus*, forming the perforation, is again reflexed and continued on to the other side of the cavity of the shell, where it is attached; the right side of the plate is broader and rounder, and the left side shorter and narrower. The generality of conchologists have so little estimation of this kind of comparison, that in studying the explanation of the structure of the genus I am laying myself open to the

observation that Mr. Lovell Reeve made on the remarks that I made respecting the development of the shell of *Humphreyia*, "That if the shell could speak it would be astonished at what was said respecting its structure."

When the structure of *Trochita*, *Crypta*, *Crucibulum*, and *Mitrella* are studied in a series, it is easy to understand and to trace out how the various forms gradually pass into each other; and the peculiarity by which the genera are separated is chiefly a modification of the inner lip. And from analogy one is convinced that the curved plate at the top of the cavity of *Calyptra* must be a modification of the same part of the shell. As yet we have not discovered any shells which show how the modifications have been brought about, or which show any intermediate form between the plate and the cup-like appendage of *Crucibulum*, or the spiral lamina of *Mitrella*, which is most developed in *Trochita*. It has been suggested that it is half of the internal cup of *Crucibulum*: but this is a mistake; for the adductor muscle is attached to the outer surface of the cup of *Crucibulum*, and to the front of the inner surfaces of *Calyptra*; so that, if it is any modification of that cup, it must be that the two sides of the cup are compressed together, and the cup-like concavity destroyed. We only know that the spiral shell that covers the just-hatched animal, instead of being extended in its spiral form, is developed into a nearly symmetrical conical shell without the least appearance of a spire, and that the inner lip of the nucleus is dilated into a curved subsymmetrical appendage attached to the apex of the upper part of the cavity, to the front or inner surface of which the adductor muscle which fixed the animal to the shell is affixed.

As *Trochita* is the most spiral, and indeed exhibits the most normal form of the shell of the family, so *Calyptra* is the most abnormally formed shell of the group. The simple conical form of the shell and its cavity gives it some resemblance to the shell of *Capulus*; and *Calyptra* differs from all the other genera of the family to which it is referred by the animal forming an under valve or shelly plate, as the animal of *Hipponyx* does among *Capulidæ*; but the position of the adductor muscle shows that the genus, though so abnormal, is properly referred to *Calyptræidæ*.

Tribe I. *Shell conical, circular, spiral; apex central; whorls several, regular; nucleus spiral; cavity circular, spiral, with an oblong four-sided mouth.* Trochitina.

1. TROCHITA, Schumacher; Adams.

Trochatella, Lesson.

Infundibulum, D'Orb.

Shell conical, circular, spiral. Apex central. Whorls several, well developed. Base circular, concave. Mouth moderate, oblong, four-sided, transverse. Axis central, imperforated, not exposed to view.

The shells are rarely flat when the animal has affixed itself over a cavity in stones or shells.

TROCHITA RADIANI.

Trochus radians, Desh.

Var. Dark chestnut (Chenu, Man. f. 2343).

T. spirata, Forbes.

Shell solid; whorls flat, with oblique ribs; margins of base dented.

Var. Shell distorted, nearly flat; whorls indistinctly marked.

Hab. Coast of Peru; Valparaiso; Straits of Magellan.

2. CLYPEOLA.

Shell conical, circular, spiral, thin. Apex central. Whorls several, well developed. Base concave, circular. Mouth large, oblong, four-sided. Axis central, imperforated, spiral, exposed to the apex of the cavity. Periostraca horny, thin, lamellar.

A *Trochila* with somewhat the appearance of a *Mitrella*.

* *Skull depressed, smooth.*

1. CLYPEOLA MAGELLANICA.

Trochita clypeolum, Reeve.

Shell thin, conical, depressed, smooth, covered with laminar foliaceous periostraca; base nearly flat.

Hab. Magellan Straits.

2. CLYPEOLA TENUIS, n. s.

Shell thin, conical, depressed, smooth.

Hab. New Zealand.

** *Shell high, conical; whorls costate.*

3. CLYPEOLA CORRUGATA.

Trochita corrugata, Reeve.

"*T. spirata*, var.," Reeve; Chenu, Man. f. 2347, 2348.

Calyptræa pileus, Lamk.; Deless. Icon. t. 34. f. 2.

Shell high, conical, acute; whorls flat, obliquely costate, or nearly smooth; base deeply concave.

Hab. Peru.

Var. *lavis*. Shell smooth and thin; the spire of the column of one specimen more exposed and open.

Hab. Falkland Islands.

3. TROCHELLA.

Shell obliquely conical, depressed. Apex subcentral. Whorls well developed, covered with a horny lamellar periostraca. Nucleus

spiral. Base oblong, concave. Aperture very large, oblong, four-sided, not quite so wide as the shell. Axis deeply concave on the right side of the base.

1. *TROCHELLA MACULATA*.

Calyptrea comma-notata, Sowerby (*Galerus chinensis* (!), Chenu, Man. f. 2350, 2351; *Calyptrea maculata*, Quoy).

Shell convex, oblique, conical, rather solid; inside purple.

Hab. New Zealand.

2. *TROCHELLA CALYPTRÆFORMIS*.

Trochus calyptreæformis, Lamk.

Shell thin, depressed, concentric, striated; spire purplish.

Hab. —?

I cannot find in the Museum Collection (including those received from Mr. Cuming) any shell that agrees with Mr. Sowerby's figure of *Calyptrea dilatata* (Chenu, Man. f. 2349). Some specimens of *Trochella maculata* are oblong or elongate, but they always have a deep impression on the right side of the hinder part of the cavity.

Mr. Swainson formed a genus for *C. dilatata* under the name of *Haliotoideus*, which has been adopted as a subgenus by Adams and Chenu.

Tribe II. *Shell oblong; apex posterior or subposterior, with a transverse plate on the hinder side of the cavity dividing it into two parts.* Cryptaina.

1. *CREPIPATELLA*, Lesson.

Crepidatella, sp., Adams.

Shell subcircular. Internal lamina concave below. Lip sharp, semicircular, separated from the columellar edge by a broad triangular slit.

1. *CREPIPATELLA DILATATA*.

Crepidula dilatata, Lamk.; Brod. (*C. peruviana*, Lamk.; Chenu, Man. f. 2352).

C. foliacea, Brod.

C. nautiloides, Lesson.

Hab. Valparaiso; Straits of Magellan; Peru.

Var. 1. *C. rugulosa*, Dunker.

Var. 2. Shell subcircular, flat. *C. strigata*, Brod.

Var. 3. Shell oval, thin, more convex, white. *C. pallida*, Brod.

2. *CREPIPATELLA FOLIACEA*, Brod.

Shell lamellar, rugose.

3. CREPIPATELLA LINGULATA, Brod.

The internal plate with a subcentral radiating fold, forming a notch in the margin of the lip.

4. CREPIPATELLA DORSATA, Brod.

The apex rather above the margin.

Hab. Vancouver Island.

2. CRYPTA, Humphrey.

Crepidula, Lamk.

Sandalium, Schum.

Shell oblong, elongate. Apex submarginal, subspiral. Internal lamina concave, covering about half the cavity. The lip transverse, nearly straight, or with a slight subcentral notch.

Messrs. H. and A. Adams formed the genus *Inacus* for the white flat specimen of this genus. All the specimens of the different species that take up their residence in the inside of the shell assume this form and colour. It has been suggested that, instead of being dependent on the accident of locality, their living in such places is a habit peculiar to the species, and a proof that they are of a distinct kind. This theory is set at rest by the fact that some specimens of the shell show the two states; that is to say, an animal growing on the outside of a shell has moved to the inside, and an animal that commenced life on the inside of a shell has moved to the outside. In the first case the apex of the shell is convex and brown, and the circumference white and flat; and in the other the apex is flat and white, and the circumference brown and convex. I have seen one specimen in which the animal has moved twice, and the shell has a brown lip and margin and a white flat intermediate space.

The change of form, surface, and colour of the shell of this family was described in my paper, published in the 'Philosophical Transactions' for 1838, and reprinted in Johnston's 'Letters on Conchology;' so there is less excuse for the formation of species, much less genera, on such characters.

* *Apex lateral, posterior, subspiral.* *Crepidula*.

1. CRYPTA ACULEATA.

Crepidula aculeata, Lamk. *Patella aculeata*, Gmelin.

C. echinus, Brod.

C. hystrix, Brod.

C. californica, Nuttall; Chenu, Man. f. 2355, 2356, 2359.

Surface with spiral lines of spines or small scales.

Hab. Jamaica; Rio Janeiro; Honduras; California; Australia; Sydney; Kurrachee; Natal; Japan.

2. CRYPTA COSTATA, Deshayes (Chenu, Man. f. 2353).

Shell with broad spiral ribs, sharp-edged above.

Var. 1. Shell convex, with brown spiral streaks.

Var. 2. Shell flat, pure white.

3. *CRYPTA PORCELLANA*, Adams ; Lamk.

Shell smooth, often irregular, costate, tubercular, or granulated from the form of the surface of the body to which they are or were attached.

Var. 1. Shell convex, coloured, varied with stripes or spots ; on the outside of shells or on rocks.

Patella porcellana, Linn.

Crepidula porcellana, Lamk.

Crepidula fornicata, *Patella fornicata*, Linn. (Chenu, Man. f. 2354?).

C. arenata, Brod.

C. excavata, Brod.

C. aplysioides, Reeve.

C. onyx, Sow.

C. marginalis, Brod.

Var. 2. Shell flat, often concave above, white ; living inside of shells or in cavities.

C. nivea et *C. squama*, Brod.

C. navicelloides, Nuttall.

C. glauca, Say.

C. unguiformis, Lamk.

C. exuviata, Nuttall (see Chenu, Man. f. 2360, 2362).

Surface altered by the body to which it is attached :—

Crepidula lirata, Reeve.

C. rugosa, Nuttall.

Hab. —?

In Messrs. Adams's 'Genera of Shells,' the species here united are scattered among the three subgenera *Crypta*, *Crepidatella*, and *Inacus*, the latter being formed from the specimens that happen to take up their abode in the cavities of shells. It was this extraordinary distribution of species so nearly allied as to be regarded as derived from the same brood or set of eggs, that induced me to undertake to make notes on them. More than one species may be combined in these synonyms, which may be distinguished by some difference in the teeth or other organs of the animal, where the animals from different localities have been examined and compared ; and if the specimens from different localities prove to be distinct, each doubtless will furnish the varieties in shape and surface produced by the form and surface of the body to which they may happen to be attached.

4. *CRYPTA SITCHANA*.

Shell smooth, covered with a paleaceous periostraca ; inner lip flat, arched inwards.

Crepidula sitchana, Middend.

Hab. Sitcha.

5. CRYPTA LESSONI.

Shell whitish, varied with brown or white; outer surface with concentric expanded lamina.

Crepidula fimbriata, Reeve.

C. lessonii, Brod.

Hab. Monterey; Upper California; Vancouver Straits.

** *Apex of shell subcentral; portions rather produced, acute.*

6. CRYPTA INCURVA.

Shell dark brown (rarely white); apex acute, rather produced, subcentral; the outer surface with close, regular, small, spiral or longitudinal ribs.

Crepidula incurvata, Brod.

Hab. Honduras. Var. 2. —?

7. CRYPTA HEPATICA, Deshayes.

Shell dark brown, smooth, with a white ray on each side of the apex; apex acute, subcentral, produced.

Crepidula hepatica, Desh.

Hab. —?

Messrs. Adams refer the first of these species to the subgenus *Crypta*, and the second to *Crepidatella*.

3. GARNOTIA, Gray.

Shell conical, cup-shaped; apex acute, posterior, above the margin; the internal lamina flat, shelving to the level of the apex, leaving a conical cavity beneath the lip, arched inwards or subtransverse.

GARNOTIA ADUNCA, Sow.

Shell smooth or subcostate, dark brown, with a small white spot on each side of the lip; inner lip pale.

Crepidula rostrata, C. B. Adams: junior?

Hab. Vancouver's Island.

Tribe III. *Shell oblong, transverse, depressed; apex scarcely raised, posterior, submarginal; nucleus distinct; spiral cavity expanded, shallow, with a transverse plate occupying about two-thirds the width on the left or pillar side of the hinder half of the cavity, and attached by each of the sides to the inside of the shell, and with a radiating fold on the lower surface, forming a radiating thickened rib, ending in a concavity like a muscular scar near the edge; the front edge on the right side of the fold short, forming a deep notch; on the left side expanded and rounded, with a notch near the pillar or right edge of the shell.* Ergæina.

The fold in the plate is evidently analogous to the fold and

cavity in the shelly plate of *Mitrella*; but the plate is attached by each of its side edges.

The more convex species might be confounded with *Crepidatella*; but they are always known by the fold forming a subcentral ridge on the lower surface of the plate, and ending in the small shallow pit like the scar of a muscle.

This group has been regarded as a subgenus of *Crypta*; but it is more allied to *Mitrella*.

1. *ERGÆA*, Adams; Chenu.

Shell nearly flat; apex posterior, marginal; nucleus spiral; whorls rapidly enlarging.

The shells when they live in cavities are concave externally,—and when living on a rough surface, corrugated like other *Calyptræidæ*.

ERGÆA WALSHI.

Crepidula walshi, Hermannsen. (*C. plana*, Chenu, Man. f. 2364. Var. distorted and rugose, *C. plana*, Adams & Reeve.)

Hab. Ceylon; Bombay.

2. *NOICIA*.

Shell subcircular or oblong, convex, spiral; whorls one and a half or two; the apex subcentral, subposterior; nucleus spiral; cavity concave, deeper under the apex; internal plates concave, thin, with the fold forming a narrow linear cavity open to the apex of the shell.

NOICIA CHINENSIS, n. s. (in Cumming's Collection).

Shell pale brown, smooth, or slightly concentrically striated.

Hab. China.

Var. Shell very thin, convex; the internal plate thin, with the fold only slightly marked and solid.

Tribe IV. *Shell conical, spiral; spire of few rapidly enlarging whorls; cavity conical, with a well-developed oblique subspiral lamina on one side, from the tip, which has the inner or pillar-edge reflexed, forming a pit or solid rib.* Mitrellina.

1. *MITRELLA*.

Shell conical, like *Poculina*; but the internal plate is oblique and subspiral; the reflexed part of the pillar-lip is closely applied to the plate, and only forming a thickened edge to the plate, there being a small impression like the scar of a muscle at the lower part of it.

1. *MITRELLA CHINENSIS*.

Shell white or rosy; outer surface with minute tubular spines or tubercles.

Patella chinensis, Montagu.

Calyptræa chinensis, Lamk., &c.

Hab. Coasts of Europe.

2. MITRELLA SPINIFERA, n. s. (not named).

Shell depressed, pellucid, crown-spotted, rugose, with oblique radiating ridges armed with tubular spines.

Hab. Kurrachee. Internal lamina imperfect.

See *Trochita spinulosa*, Chenu, Man. f. 2344.

3. MITRELLA SUBREFLEXA.

Calyptrea subreflexa, Carpenter.

Pale brown, smooth, pellucid.

Hab. California.

4. MITRELLA PELLUCIDA.

Calyptrea pellucida, Reeve.

Shell very thin, transparent, smooth.

Hab. —?

2. TROCHILINA.

Shell like former; but the internal plate is much more oblique and spiral, and the reflexed part of the upper portion of the pillar-lip is united to the surface of the plate, forming a short deep compressed perforation near the apex of the cavity.

1. TROCHILINA CONICA.

Calyptrea conica, Brod.

Shell conical, rather thin, pale, brown-spotted, smooth.

Hab. —?

This shell varies greatly in the extent of the internal lamina: in most specimens it occupies much more than one whorl; but in another, which may have been injured, the plate does not occupy more than one-third of a whorl.

2. TROCHILINA FASTIGIATA.

Calyptrea fastigiata, Gould.

Shell conical, circular, smooth, with a smooth pale-brown peristoma.

Hab. Vancouver's Island.

3. TROCHILINA ADSPERSA.

Calyptrea adspersa, C. B. Adams.

Shell depressed, pellucid, brown-dotted.

Hab. —?

4. TROCHILINA MAMILLARIS.

Calyptrea mamillaris, Brod.

Shell solid, white, smooth, opaque, with a red or purple tip; internal plate very thin, transparent.

Hab. California.

5. TROCHILINA SOLIDA.

Calyptræa solida, Reeve.

Shell high, conical, solid, smooth, opaque, white; inner surface and apex purple brown; internal plate very oblique, white.

Hab. Conchagua (*C. A.*).

6. TROCHILINA LICHEN.

Calyptræa lichen, Brod.

Shell very depressed, white, with a few obscure reddish dots, smooth.

Hab. —?

3. POCULINA.

Shell conical; base circular, deeply concave; apex acute, central; nucleus spiral; cavity conical, with an oblique triangular subspiral lamina on one of the sides, which has the pillar bent back so as to form a large deep concavity or umbilicus extending to the apex of the cavity.

This genus is distinguished from *Mitrella* by the apex being distinctly spiral.

1. POCULINA UNGUIS.

Calyptræa unguis, Brod.*C. solida*, Brod. (Chenu, Man. f. 2340).

Shell solid, high, conical, smooth, brown.

Hab. —?

2. POCULINA POCULUM.

Calyptræa poculum, Reeve.

Shell thin, conical, smooth, white or pale brown.

Hab. —?

3. POCULINA AURITA.

Calyptræa aurita, Reeve (Chenu, Man. f. 2336).

Shell depressed, conical, broad, thin, pale brown; outer surface closely and regularly radiately striated.

Hab. —?

Tribe V. *Shell conical, subspiral; the cavity simple, conical; the internal lamina moderate, oblique, irregular, with the edge of the pillar-lip reflexed, forming a narrow elongated deep marginal cavity.*

GALERUS, Humphr. ; Adams.

Mitrella, Leach.*Mitrula*, Gray.*Infundibulum*, J. Sow.

Shell circular, conical; apex acute, central; nucleus spiral, erect; cavity circular, regular, conical, with an oblique plate projecting into the cavity on the pillar side, which has a narrow, conical, compressed, cup-shaped cavity on its outer margin.

1. GALERUS EXTINGTORIUS, Adams.

Calyptræa extingtoria, Lamk.

C. morbidum, Reeve.

Shell smooth, white, with diverging brown lines; the lamina as wide as the width of the cup-shaped cavity.

Surface distorted. *C. verrucosum*, Reeve. (*C. lævigata*, Chenu, Man. f. 2337.)

Hab. Molucca; Tranquebar; China.

2. GALERUS LIVIDUS.

Calyptræa lividum, Reeve.

Shell dark brown, horn-colour, pellucid; the lamina near the cup-shaped cavity very narrow, not nearly so wide as the cavity.

Hab. —?

Tribe VI. *Shell circular, regular, conical, subspiral; apex central, acute; nucleus spiral; cavity regular, conical, with an oblique or spiral lamina from the apex, which is elongate, with a slightly reflexed edge near the apex of the cavity, or shorter, oblique, with the pillar-edge reflexed, making a more or less deep and large cup-like appendage.* Disputeana.

The passage from the small, slender, deep perforation under the reflexed portion of the pillar-lip to the large cup-like appendage of the Cup-and-Saucer Limpet (*Crucibulum*) is very gradual.

* *Cup-like cavity large, compressed, narrow, close on the inner surface of the shell.*

1. NELETA.

Shell subcircular, conical, depressed; apex acute, central; nucleus spiral, radiately costate; cavity circular, conical, with a narrow compressed deep cup-shaped concavity on the side, attached to the shell by the whole of its inner surface, open to the tip; the side next to cavity of the shell not thickened or rounded.

Very different from the young of *Crucibulum scutellatum*, and from *Catellina pectinatum*, by the compressed form of the cup, and by the cup not being callous at the tip.

NELETA SERRATA.

Calyptræa serrata, Brod.

Shell conical, depressed; cone rather thin, pellucid, strongly ra-

diately costated; the internal cavity small, compressed, open to the apex of the shell.

Hab. —?

2. TRELANIA.

Shell circular, depressed, conical; apex nearly central, acute; nucleus subspiral; cavity circular, conical, with a narrow lunate deep compressed cup-shaped cavity attached to the inner surface of the shell by the apex and one of the sides, rest free; the edge of the cavity complete and free from the inner surface of the shell.

TRELANIA RADIATA.

Calyptræa radiata, Brod.

Shell brown-rayed, with numerous narrow, close, regular, radiating striae.

Hab. California.

** *Cup-shaped appendage large, broad, triangular.*
"Cup-and-Saucer Limpets."

1. CATILLINA.

Shell oblong, conical, radiately ribbed; the apex acute, subcentral, recurved; nucleus regular, spiral, of one whorl and a half; the cavity conical, with a broad trigonal cup on the left side under, but not extending to, the apex of the cavity, filled with a callous deposit at the tip; the part of the cup next to the inner surface of the shell scarcely thickened and not raised up.

CATILLINA PECTINATA.

Shell conical, high, solid, thick; the cup large, open, triangular, with the upper part filled with a thick calcareous deposit.

Calyptræa pectinata, Carpenter.

C. concamerata, Reeve. (Chenu, Man. f. 2337, 2339.)

Hab. —?

Very like a small *Crucibulum scutellatum*. The upper part of the cup is always partly filled up by a calcareous deposit, and the edge of the cavity next to the inner surface of the shell is not thickened or raised.

2. DISPOTEA, Adams.

"Calypcopsis, Lesson."

Shell circular, conical; the apex acute, posterior, recurved considerably above the edge; nucleus subspiral, lateral; the cavity conical; apex subspiral, with a broad large trigonal cup-like cavity under the apex, attached to the cavity by one of its sides, the edge of which is not raised or thickened; the outer or right lip of the cup straight, spreading, cavity open to the tip.

This chiefly differs from the former genus in the inner lip not being reflexed over the cavity of the cup.

* *Cup conical, deep; shell striated, edge crenated.*

1. *DISPOTEA STRIATA*, Adams.

Calyptrea striata, Say; Chenu, Man. f. 2342.

Shell circular, radiately costated; costæ interrupted by the smooth lines of growth; the cup conical, deep; the right edge straight, even. See *D. cancellata*, Adams & Reeve.

** *Cup concave, shallow; shell smooth, edge even.*

2. *DISPOTEA BILOBATA*.

"*Calyptrea bilobata*, Gray."

Shell thin, oblong or ovate, white, brown-rayed, smooth, minutely rugulose, sublaminal; the cup concave, shallow, the right lip flexuous, two-lobed.

Hab. California.

2. *CRUCIBULUM*, Schumacher; Adams.

Biconia, Swainson.

Calyptropsis, Brod. (not Lesson).

Dispotea, Say.

The shell circular, depressed, conical; apex nearly central, acute; nucleus subspiral; cavity circular, conical, with a broad subtriangular cup-shaped cavity attached by the upper part of one of its sides, but with the edges free from the cavity of the shell on every side.

In the young shell the internal cup is imperfect, consisting of a narrow triangular curved subspiral cavity, without any shelly deposit on the inner side of the cup next to the surface of the shell. As the shell enlarges, the width of the side of the cup decreases, and the edge is completed and at length elevated from the inner surface of the shell.

* *The internal cup broad, rather longer than broad.*

1. *CRUCIBULUM SCUTELLATUM*.

Calyptrea scutellata, Gray.

Crucibulum imbricatum, Brod.

C. umbrella, Desh. (shell very flat).

C. lignaria, Brod.

C. corrugatum, P. Carpenter.

C. ferrugineum, Reeve.

C. trigonale, Adams & Reeve.

C. rugosum, Deshayes.

C. tenuis, Broderip.

Dispotea spectrum.

Shell solid, brown (or pale, with brown rays), with broad flat radiating and concentric ridges, or more or less smooth and closely radiately striated (Chenu, Man. f. 2332, 2335, 2338).

Hab. West Coast of America; Valparaiso; Chiloe; Gulf of California.

The smooth specimens sometimes have costated or cancellated tips, and the converse. The surfaces of the different varieties and the form of the shells are often altered by the form and surface of the body to which they are attached.

2. CRUCIBULUM AURICULATUM.

Patella auriculata, Chemn. *Dispotea auriculata*.

Shell white, brown-spotted, and varied with distant regular sharp-edged radiating ribs; inner surface white or brownish.

Hab. West Indies; St. Thomas's; Cumana.

The Atlantic form of the preceding.

3. CRUCIBULUM VIOLACEUM, Carpenter.

Shell white, brown-varied, with close regular round-topped radiating ribs; inner surface purplish.

Hab. Ceylon.

4. CRUCIBULUM MACULATUM.

Calyptræa maculata, Brod.

Shell white, solid, brown-spotted, with very close, round-topped, nearly regular radiating ribs.

Hab. —?

5. CRUCIBULUM TUBIFERUM.

Dispotea tubifera, Say.

Crucibulum spinosum, Sowerby.

C. hispidum, Brod.

Chenu, Man. f. 2333, 2334.

Shell solid, brown, or brown white-rayed; closely radiately striated, and often with more or less close radiating ribs furnished with tubular spines.

Hab. Peru; Gulf of California.

Tribe VII. *The shell conical, subcircular; apex central, acute; cavity regular, conical, with a folded plate at the top of the cavity, free from the sides; the foot of the animal secreting a lower calcareous plate.* Calyptrina.

CALYPTRA, Humphrey; Adams.

Calyptræa, Lamk.

Calyptrus, Mont.

Mitrularia, Schum.

Calyptria, *Lithedaphus*, et *Litholepas*, Owen.

* *Shell entire, without spines.*

1. CALYPTRA CORRUGATA, Adams; Chenu, Man. f. 2326, 2328.

Calyptræa corrugata, Brod.

Var. smaller. *C. layardi*, Reeve. ? *C. umbo*, Reeve.

Shell solid, with high, compressed, edged, distant radiating ribs.
Hab. —?

2. CALYPTRA ADAMSII, Reeve.

Calyptra depressa, Adams & Reeve.

Shell thin, with close, sharp-edged, regular radiating and concentric ridges, minutely striated between the ridges.

Hab. —.

3. CALYPTRA ALVEOLATA, A. Adams.

Var. 1. Small. *C. umbo*, Reeve. *C. vanikorensis*, Quoy. *C. cancellata*, Reeve.

Var. 2. Thick, flat. *C. varia*, Brod.

Shell solid, with close, radiating, sharp-edged ribs, and more or less distinct low concentric ridges.

Hab. Philippines; Galapagos Islands.

4. CALYPTRA EQUESTRIS, Chenu, Man. f. 2322, 2323.

Patella equestris, Linn.?

Calyptra papyracea, A. Adams.

? *C. radiosa*, Gould. (Bad state, with another species.)

C. scutulum, Reeve.

Shell solid, with sharp-edged radiating ribs, and small radiating lines between them.

Hab. Philippines.

5. CALYPTRA STELLA, Reeve.

Shell depressed, solid, with very close, flat-topped, radiating ribs, which are sometimes alternately smaller.

Hab. —?

6. CALYPTRA TECTUM-SINENSE, Gray, 1824.

Calyptra cepacea, Brod.

C. martiniana, *C. diaphana*, *C. scabies*, *C. domitoria*, *C. tortilis*, *C. cornea*, *C. stallonia*, *C. cicatricosa*, *C. ossea*, *C. saccharimeta*, *C. balanoides*, *C. uncinata*, *C. hipponiceformis*, *C. porosa*, *C. cyathella*, et *C. fibulata*, Reeve.

C. depressa, Adams & Reeve.

Shell thin, very finely, regularly, radiately striated.

Var. with expanding concentric lamina.

Patella tectum sinensis, Chemn.; Chenu, Man. f. 2324, 2325.

Hab. Philippine Islands.

I am by no means certain that the six species here distinguished are distinct. *C. stella* seems most distinct from the rest; but there is only one specimen, and Mr. Cuming has mated it with a small specimen of *C. equestris*. They all seem to live together at the Philippine Islands.

** *Shell with tubular spines.*

7. CALYPTRA TUBIFERA.

Shell thin, pellucid, smooth, with distant, short, tubular spines formed on the edge of the shell, and closed up below as the shell enlarges.

Hab. Honduras. A single specimen, which was not named in the cabinet.

11. Catalogue of Birds collected by Mr. E. Bartlett on the River Huallaga, Eastern Peru, with Notes and Descriptions of New Species. By P. L. SCLATER, M.A., Ph.D., F.R.S., and OSBERT SALVIN, M.A. &c.

(Plate XXXIV.)

Mr. E. T. Higgins having kindly allowed us to examine Mr. E. Bartlett's second collection of birds from Eastern Peru before its dispersal, we have the pleasure of submitting the following account of it to the Society.

The present collection was formed during the excursion spoken of in the letter of which an extract is given in the Society's 'Proceedings' for January 1867*, and was mainly amassed at three localities—Yurimaguas, Xeberos, and Chyavetas.

Yurimaguas is an Indian town on the Huallaga, about sixty miles from its embouchure into the Amazon, mentioned in Herndon and Gibbons's 'Exploration of the Amazon' (p. 171).

Xeberos is an Indian village, about fifty miles north-west of Yurimaguas, on a small river (the Aypena) which flows into the Amazon just above the Huallaga.

Chyavetas, or *Chayavetas*, is situated about seventy miles west of Yurimaguas.

All these three places are marked in the copy of the Spanish map (of 1790) attached to Herndon's volume.

The whole collection consists of nearly 1000 skins, referable to 205 species. Of these but very few are new to science, almost the only noticeable exception being the new *Chætura* described below. This may probably arise from the fact that Mr. Hauxwell collected largely at Chamicuros (a village situated upon the opposite bank of the Huallaga, but in the same neighbourhood) in 1854, and that his collections appear to have been widely dispersed in Europe. In comparing the present collection with the former collection from the Ucayali, we find only 94 species common to the two, while 112 species are in the Huallaga collection which had not been previously obtained by Mr. Bartlett.

The following is a list of the species of birds collected at the three

* See *antèa*, p. 2.



J.S.

+ CHETURA BRACHYCERCA

localities above mentioned in a tabular form, the necessary notes being added subsequently*. The nomenclature employed is that of Selater's 'Catalogue of American Birds.'

	Xeberos.	Yurinaguas.	Chyvetas.
TURDIDÆ.			
†1. <i>Turdus phæopygus</i>	..	..	*
2. — <i>amaurochalinus</i>	*		
TROGLODYTIDÆ.			
3. <i>Cyphorhinus modulator</i>	..	..	*
†4. <i>Troglodytes tessellatus</i>	*	..	*
SYLVICOLIDÆ.			
†5. <i>Basileuterus uropygialis</i>	..	..	*
HIRUNDINIDÆ.			
6. <i>Progne tapera</i>	*		
†7. — <i>leucogastra</i>	*		
8. <i>Atticora fasciata</i>		*	
9. — <i>cyanoleuca</i>	..	..	*
10. <i>Stelgidopteryx ruficollis</i>	..	*	
VIREONIDÆ.			
11. <i>Vireosylvia agilis</i>	..	..	*
CEREBIDÆ.			
12. <i>Hemidacnis albiventris</i>	*		
13. <i>Dacnis cayana</i>	*		
14. — <i>melanotis</i>	*		
15. <i>Cœreba cœrulea</i>	*		
16. — <i>cyanea</i>	*		
17. — <i>nitida</i>	*		
18. <i>Chlorophanes atricapilla</i>	*		
TANAGRIDÆ.			
19. <i>Procnias occidentalis</i>	*		
20. <i>Euphonia minuta</i>	*		
21. — <i>rufiventris</i>	*		
22. <i>Calliste yeni</i>	*	..	*
23. — <i>schiranki</i>	*	..	*
24. — <i>gyroloides</i>	..	..	*
25. <i>Tanagra cœlestis</i>	*		
26. — <i>melanoptera</i>	*		
27. <i>Ramphocœlus jacapa</i>	*		
28. <i>Phœnicothera rubica</i>	..	*	*
†29. <i>Tachyphonus phœniceus</i>	*		
30. — <i>rufiventris</i>	..	*	*
†31. — <i>surinamus</i>	*	..	*

* The collection contained also thirteen skins from Nauta, amongst which were *Ocyalus latirostris*, Waterh., *Psittacula passerina* (Linn.), *Buteogallus nigricollis* (Lath.), *Herodias egretta* (Gm.), and *Nycticorax pileatus* (Lath.), not before mentioned from this locality.

	Xeleros.	Yurimaguas.	Chayvetas.
32. <i>Nemosia auricollis</i>	*	..	*
33. <i>Chlorospingus flavigularis</i>	..	..	*
34. <i>Cissopis media</i>	*	*	..
35. <i>Saltator magnus</i>	*	*	..
FRINGILLIDÆ.			
+ 36. <i>Guiraca cyanooides</i>	..	..	*
37. <i>Oryzoborus crassirostris</i>	*	..	..
38. — <i>torridus</i>	*	..	..
39. <i>Spermophila luctuosa</i>	*	..	*
40. <i>Volatinia jacarina</i>	*	..	..
41. <i>Coturniculus peruanus</i>	..	..	*
ICTERIDÆ.			
+ 42. <i>Clypiterus oseryi</i>	*	..	..
43. <i>Ostinops cristatus</i>	..	..	*
44. — <i>viridis</i>	*	..	..
45. <i>Leistes guianensis</i>	*	..	..
CORVIDÆ.			
46. <i>Cyanocorax violaceus</i>	..	..	*
DENDROCOLAPTIDÆ.			
+ 47. <i>Sclerurus mexicanus</i>	..	*	..
48. — <i>caudacutus</i>	..	*	*
49. <i>Synallaxis rutilans</i>	*	..	*
50. <i>Ancistrops lineaticeps</i>	*	..	*
51. <i>Automolus sclateri</i>	*	..	*
52. <i>Glyphorhynchus castelnaudi</i>	..	..	*
+ 53. <i>Xenops approximans</i>	..	..	*
+ 54. <i>Dendrocolaptes radiolatus</i>	..	*	..
+ 55. <i>Dendromis ocellata</i>	*	..	..
56. —, sp. inc.	..	..	*
FORMICARIIDÆ.			
+ 57. <i>Thamnophilus fuliginosus</i>	*	..	..
58. — <i>melanurus</i>	..	..	*
+ 59. — <i>murinus</i>	*	..	..
60. <i>Pygoptila maculipennis</i>	*	..	..
61. — <i>margaritata</i>	*	..	..
+ 62. <i>Dysithamnus schistaceus</i>	..	*	*
+ 63. — <i>ardesiacus</i>	..	..	*
64. <i>Thamnomanes glaucus</i>	*	*	*
65. <i>Myrmotherula pygmaea</i>	*	*	*
+ 66. — <i>hamatonota</i>	*	..	*
67. — <i>melana</i>	*	..	*
+ 68. — <i>cinereiventris</i>	..	..	*
69. — <i>hauxwelli</i>	..	..	*
70. <i>Ramphocæmus melanurus</i>	..	..	*
71. <i>Cercomacra cinerascens</i>	..	..	*
+ 72. <i>Myrmeciza hemimelana</i>	*	..	..
73. <i>Hypocnemis cantator</i>	*	..	*
+ 74. — <i>myiotherina</i>	*	*	*
75. — <i>theresæ</i>	*	..	..

	Xebros.	Yurimaguas.	Chayvetas.
76. <i>Pithys albifrons</i>	..	..	*
77. — <i>leucospis</i>	*	..	*
78. <i>Myrmelastes plumbeus</i>	*	..	*
79. <i>Formicarius analis</i>	*	..	*
TYRANNIDÆ.			
+80. <i>Euscarthmus spicifer</i>	*	..	*
81. <i>Mionectes oleagineus</i>	*	..	*
+82. <i>Leptopogon peruvianus</i>	..	..	*
83. <i>Tyrannulus elatus</i>	..	..	*
84. <i>Elainea modesta</i>	*	..	*
85. <i>Rhynchocyclus sulphureus</i>	*	..	*
86. — <i>megacephalus</i>	*	..	*
87. <i>Pitangus sulphuratus</i>	..	*	..
88. <i>Myiodynastes solitarius</i>	*	*	*
89. <i>Myiobius erythrurus</i>	*	..	*
90. — <i>barbatus</i>	*	..	*
91. <i>Pyrocephalus rubineus</i>	*	..	*
+92. <i>Empidonax fuscatus</i>	*	..	*
93. —, sp. ign.	..	*	..
94. —, sp. ign.	*	..	..
+95. <i>Tyrannus aurantio-atro-cristatus</i>	*	..	..
96. — <i>melancholicus</i>	*	..	*
COTINGIDÆ.			
+97. <i>Tityra albitorques</i>	..	..	*
98. <i>Pachyrhamphus atricapillus</i>	*	..	*
+99. <i>Lipaugus lateralis</i>	..	..	*
+100. <i>Iodopleura isabellæ</i>	*	..	..
101. <i>Pipra auricapilla</i>	..	..	*
102. — <i>leucocilla</i>	*	*	*
103. — <i>cornuta</i> , ♀	..	..	*
104. — <i>cyaneocapilla</i>	..	..	*
105. —, sp. ign., ♀	*	..	*
+106. <i>Chloropipo</i> , sp. ign., ♀	..	..	*
107. <i>Machæropterus striolatus</i>	*	..	*
108. <i>Chromochæris manacus</i>	..	..	*
109. <i>Phenicocercus nigricollis</i>	*	..	..
110. <i>Rupicola peruviana</i>	..	..	*
111. <i>Cotinga cayana</i>	*	..	..
112. <i>Cephalopterus ornatus</i>	..	..	*
MOMOTIDÆ.			
113. <i>Momotus martii</i>	..	..	*
ALCEDINIDÆ.			
114. <i>Ceryle superciliosa</i>	..	..	*
GALBULIDÆ.			
115. <i>Galbula albirostris</i>	*	..	*
BUCCONIDÆ.			
116. <i>Buceo collaris</i>	..	..	*
117. — <i>macrodactylus</i>	*	..	*

	Xeberos.	Yurimaguas.	Chayvetas.
118. <i>Malacoptila fusca</i>	..	..	*
119. <i>Nonnula frontalis</i>	..	..	*
120. <i>Monasa flavirostris</i>	..	..	*
121. — <i>peruana</i>	..	..	*
122. <i>Chelidoptera tenebrosa</i>	*	..	*
TROGONIDÆ.			
123. <i>Trogon viridis</i>	..	..	*
124. — <i>melanurus</i>	*	..	..
CAPRIMULGIDÆ.			
125. <i>Nyctidromus albicollis</i>	*	..	..
126. <i>Antrostomus parvulus</i>	*	..	..
CYPSELIDÆ.			
127. <i>Chætura zonaris</i>	..	..	*
†128. — <i>brachycerca</i> , sp. nov.	*	..	..
129. <i>Cypselus squamatus</i>	*	..	..
TROCHILIDÆ.			
130. <i>Phaëthornis malaris</i>	*	..	*
131. — <i>boucieri</i>	*	..	*
132. <i>Pygmornis amaura</i>	..	..	*
133. — <i>nigricinctus</i>	*	..	..
134. <i>Glaucis affinis</i>	*	*	*
135. <i>Campylopterus aquatorialis</i>	..	..	*
136. <i>Aphautochroa gularis</i>	..	..	*
137. <i>Lampornis maugo</i>	*	..	..
138. <i>Doryfera johanna</i>	..	..	*
139. <i>Thalurania tshudii</i>	*	..	*
140. <i>Florisuga mellivora</i>	*	..	*
141. <i>Clais guimeti</i>	..	..	*
142. <i>Polenistria verreauxi</i>	*	..	..
143. <i>Gouldia langsdorffi</i>	*	..	*
144. <i>Calliphlox amethystina</i>	..	..	*
†145. <i>Polytmus leucorrhous</i>	*	..	..
146. <i>Clytolama aurescens</i>	..	..	*
147. <i>Helimaster longirostris</i>	..	..	*
148. <i>Hylocharis cyanea</i>	*	..	..
149. — <i>sapphirina</i>	*	..	..
150. <i>Thaunantias fluviatilis</i>	..	*	..
151. <i>Chrysuronia josephina</i>	*	..	..
152. <i>Eucephala cerulea</i>	..	*	..
CUCULIDÆ.			
†153. <i>Piaya mehleri</i>	..	..	*
†154. — <i>melanogastra</i>	..	..	*
155. <i>Coccyzus melanocoryphus</i>	..	..	*
RAMPHASTIDÆ.			
156. <i>Ramphastus ambiguus</i>	..	..	*
157. — <i>cuvieri</i>	..	..	*
158. — <i>inea</i>	..	..	*
159. — <i>culminatus</i>	..	..	*

	Xeberos.	Yurimaguas.	Chayvetas.
160. <i>Pteroglossus pluricinctus</i>	..	..	*
161. — <i>humboldti</i>	..	..	*
162. — <i>flavirostris</i>	*	..	..
163. <i>Selenidera reinwardti</i>	..	..	*
CAPITONID.E.			
164. <i>Capito peruvianus</i>	*	..	..
165. — <i>aurovirens</i>	..	*	..
PICID.E.			
166. <i>Campephilus trachelopyrus</i>	..	*	..
167. — <i>albirostris</i>	..	*	*
168. <i>Celeus citrinus</i>	*	..	..
†169. — <i>citreopygius</i>	..	*	..
170. <i>Chloronerpes hematostigma</i>	*	..	*
171. <i>Melanerpes cruentatus</i>	..	..	*
PSITTACID.E.			
172. <i>Ara macao</i>	..	..	*
173. <i>Conurus cyanopterus</i>	*	..	*
174. — <i>souancæi</i>	..	*	*
175. <i>Brotagerys jugularis</i>	..	*	*
176. <i>Chrysotis amazonica</i>	..	..	*
177. † <i>Pionus menstruus</i>	*	..	..
178. <i>Caica melanocephala</i>	..	*	*
179. — <i>barrabaudi</i>	..	..	*
†180. <i>Urochroma lueti</i>	*	..	..
VULTURID.E.			
181. <i>Gyparchus papa</i>	*	..	..
182. <i>Cathartes aura</i>	..	..	*
FALCONID.E.			
183. <i>Ibycter americanus</i>	..	..	*
184. <i>Morphnus guianensis</i>	..	..	*
185. <i>Urubitinga zonura</i>	..	..	*
186. <i>Herpetotheres cachinnans</i>	..	*	..
187. <i>Spizaetus ornatus</i>	..	..	*
188. <i>Asturina magnirostris</i>	*	..	*
†189. <i>Micrastur mirandollii</i>	..	..	*
190. <i>Harpagus bidentatus</i>	..	..	*
191. <i>Ictinia plumbea</i>	..	..	*
STRIGID.E.			
192. <i>Strix perlata</i>	*	..	..
193. <i>Syrnium</i> , sp. ign.	..	..	*
COLUMBID.E.			
194. <i>Columba speciosa</i>	..	..	*
195. <i>Chamæpelis amazilia</i>	*	..	..
196. <i>Peristera cinerea</i>	*	..	..
197. <i>Geotrygon montana</i>	*	..	*
PERDICID.E.			
198. <i>Odontophorus stellatus</i>	..	..	*

	Xeberos.	Yurimaguas.	Chyavetas.
TINAMID.E.			
199. <i>Tinamus parvirostris</i>	..	..	*
RALLID.E.			
200. <i>Porzana cayanensis</i>	*		
201. <i>Heliornis fulica</i>	..	..	*
SCOLOPACID.E.			
202. <i>Tringites rufescens</i>	*		
203. <i>Tringa maculata</i>	*		
ARDEID.E.			
204. <i>Ardea agami</i>	..	*	
LARID.E.			
205. <i>Rhynchops melanurus</i>	*		

The following notes apply to such of the above-mentioned species as are marked (+):—

(1.) *TURDUS PHÆOPYGUS*, Cab.

Chyavetas. Three examples; rather darker on the back than Cayenne specimens.

(4.) *TROGLODYTES TESSELLATUS*, Lafr. et D'Orb.

Four examples from Xeberos and Chyavetas. Rather more fulvous below than in Panama specimens.

(5.) *BASILEUTERUS UROPYGIALIS*, Slater, P. Z. S. 1861, p. 128, et 1866, p. 286, t. x. f. 2.

One example from Chyavetas, agreeing with the type in Slater's collection. This is a singular locality for the species, as we had believed it to be peculiar to Panama.

✱ (7.) *PROGNE LEUCOGASTRA*, Baird.

Many skins from Xeberos and Yurimaguas. "Generally seen in flocks about the church at Yurimaguas."—E. B.

(29.) *TACHYPHONUS PHENICEUS*, Sw. An. in Menageries, p. 311; Slater, P. Z. S. 1856, p. 116.

Three examples of this scarce species from Xeberos. Natterer obtained specimens on the Madeira.

(31.) *TACHYPHONUS SURINAMUS* (Linn.).

Many specimens from Xeberos and Chyavetas of both sexes of a local form of *T. surinamus*, which is probably the bird indicated by Lawrence (Ann. L. N. Y. viii. p. 42) as *T. napensis*. It differs from

the Cayenne bird principally in its smaller size and darker uropygial band. The females seem also different from those of the typical form, being of a brighter ochreous behind, and having the yellow circlet round the eye much less defined—in some specimens hardly apparent. Specimen *c* of *Tachyphonus surinamus* (from Guia) of Sclater's collection (Cat. A. B. p. 85) also belongs to this form.

(42.) *CLYPTERUS OSERYI* (Deville).

Cassicus oseryi, Deville, Rev. Zool. 1849, p. 57; Des Murs, Zool. Voy. Casteln. p. 66, pl. 18. f. 3.

Clypterus oseryi, Bp. Consp. i. p. 426.

One example of this fine species, not quite adult, from Xeberos. It is the first time we have met with it.

†(47.) *SCLERURUS MEXICANUS*, Sclater.

See our observations on this species (*anteà*, p. 574). It is interesting to meet with a second southern specimen, confirming our views there expressed.

†(53.) *XENOPS APPROXIMANS*, Pelzeln, Sitz. Ak. Wien, xxxiv. p. 113 (1859).

Two examples of this form from Chyavetas, agreeing with one of Natterer's typical skins of this species in Sclater's collection.

†(54.) *DENDROCOLAPTES RADIOLATUS*, Sclater, MS.

One example from Yurimaguas of a species in Sclater's collection allied to *D. cayennensis* and *D. sancti-thomæ* of Central America. It may be characterized as follows:—

Similis D. cayennensi, sed major, supra et subtus omnino fasciis nigris distincte transradiolatus: alis et cauda ferrugineo-rufis, alarum tectricibus nigro transradiatis: rostro pallide corneo; pedibus fuscis: long. tota 12·5, alæ 5·0, caudæ 4·7, rostri a rictu 1·9 poll. Angl.

Hab. in Peruv. orient. Yurimaguas (*Bartlett*).

In *D. sancti-thomæ* the lower back is rufous, unbarred; the radiations are much closer, the bill is smaller and nearly black, and the whole bird is smaller.

A fourth species of this group (the only other with which we are acquainted) is the newly described *D. concolor*, Pelzeln.

(55.) *DENDROORNIS OCELLATA*, Spix.

Dendrocolaptes ocellatus, Spix, Av. Bras. i. p. 88, t. 91. f. 1.

A single specimen agrees with a skin (determined by Pelzeln to belong to Spix's species) in Sclater's collection, collected by Natterer on the Rio Negro.

(57.) *THAMNOPHILUS FULIGINOSUS*, Gould.

A female, probably of this species, from Xeberos. A somewhat similar specimen is in the British Museum.

+ (59.) THAMNOPHILUS MURINUS.

Thamnophilus murinus, Natt. MS. sp. no. 923.

Xeberos. Specimens of both sexes of this species, of which Sclater has three examples in his collection under Natterer's MS. name. They may be characterized as follows:—

Schistaceus, subtus valde dilutior, ventre medio pæne albo: macula dorsi medii celata alba: alis fusciscenti-ochraceis, maculis tectricum terminalibus albis: cauda schistaceo-nigra, apicibus rectricum anguste albis: long. tota 5·3, alæ 2·4, caudæ 2·1, rostri a rictu 0·8.

Fœm. Fusca; subtus dilute ochracea, medialiter albescens: pileo alis et cauda rufescentibus: maculis tectricum terminalibus ochraceiscentibus.

Hab. Cayenne (*Mus. P. L. S.*); Marabitanas et Barra do Rio Negro (Natterer); Xeberos (Bartlett).

Obs. Species parva; affinis *Th. cærulescenti* et *Th. amazonico*, sed sane distincta.

(62.) DYSITHAMNUS SCHISTACEUS, D'Orb.

Yurimaguas and Chyavetas. This appears to be the true *Thamnophilus schistaceus* of D'Orbigny (figured Voy. t. 5. f. 1 under the name *Th. fuliginosus*); but it is not the same as the species referred to by Sclater in his articles in P. Z. S. (1858, pp. 66, 222) and American Catalogue. The latter is distinguishable by its white dorsal spot, darker cinereous colour below, and the narrow white terminations of the tail-feathers. For this species, of which one female skin is likewise in Bartlett's collection, we propose the new name *Dysithamnus ardesiacus*.

(66.) MYRMOTHERULA HÆMATONOTA, Sclater, P. Z. S. 1858, p. 235; Sclat. et Salv. P. Z. S. 1866, p. 185.

Xeberos and Chyavetas. Several specimens of this interesting species, and of each sex.

+ (68.) MYRMOTHERULA CINEREIVENTRIS.

Myrmotherula cinereiventris, Sclater, MS.

♂. *Cinerea, paulo pallidior, unicolor: tectricum alarum apicibus nigris albo terminatis: cauda nigro-cinerea, apice vix pallescente: long. tota 3·5, alæ 2·1, caudæ 1·1.*

♀. *Supra cinerea, capitis lateribus et corpore subtus cinnamomeis.*

Hab. Cayenne (*Mus. P. L. S.*); Surinam (*C. Bartlett*); Rio Napo (*Verreaux*); Eastern Peru, Chyavetas (*E. Bartlett*).

Obs. Species, affinis *M. axillari* et ejusmodi formæ, sed corpore toto subtus cinereo ab aliis prorsus notabilis.

Mr. E. Bartlett's collection contains many examples of this species, which appears to be undescribed. Sclater's collection contains several skins of it from various localities.

(72.) MYRMECIZA HEMIMELÆNA, Selater, P. Z. S. 1858, p. 249.

A single skin, agreeing with the typical specimen in the British Museum.

(74.) HYPOCNEMIS MYIOTHERINA (Spix).

A series of ten specimens of this species proves, what we had long suspected, that "*H. melanosticta*, Selater, ♂" (as figured P. Z. S. 1854, pl. LXXIII.), is the young male of this bird before the black throat is attained; and "*H. melanosticta*, ♀," the female of this species. *H. elegans*, Selater, of Bogota, is also probably merely the female of the same bird rather more deeply coloured below.

(80.) EUSCARTHMUS SPICIFER (Lafr.).

See our remarks on this species, P. Z. S. 1866, p. 187.

†(82.) LEPTOPOGON PERUVIANUS, sp. nov.

Similis L. amaurocephalo, ex Brasilia or. merid., sed minor: pileo saturatiore, et cauda brunnea unicolore: long. tota 4·5, alæ 2·3, caudæ 2·0.

Hab. Peruv. orient. Chyavetas (Bartlett).

Dr. Cabanis has lately separated the northern form of this species as *L. pileatus* (Journ. f. Orn. 1855, p. 414). This is a third local form, resembling *L. pileatus* in the deep colour of the head, but smaller than either of the others, and without any green edgings to the tail-feathers. The bill of the single specimen sent is rather stouter, and the chest somewhat darker.

(92.) EMPIDOCANES FUSCATUS (Max.).

See our remarks on this bird (*anteà*, p. 578). We should rather have expected to find here the Cayenne form *E. olivus*.

(95.) TYRANNUS AURANTIO-ATRO-CRISTATUS, Lafr. et D'Orb.

See P. Z. S. 1866, p. 190.

†(97.) TITYRA ALBITORQUES, Du Bus.

This is the true *Tityra albitorques* of Du Bus (Bull. Acad. Brux. xiv. p. 104); and we are now for the first time enabled to compare it with the Mexican and Central American form, which we have hitherto referred to the same species. They are decidedly separable as local forms; and the northern bird, being the *Psaris fraseri* of Kaup, may be called *Tityra fraseri*. It is larger than the present species, has a much longer bill, and the black bar on the tail much broader.

(99.) LIPAUGUS LATERALIS, G. R. Gray; Selat. et Salv. Ex. Orn. p. 6.

In our synopsis of these birds in 'Exotic Ornithology' we have kept the present Peruvian form separate from the Brazilian *L. hypopyrrhus*. The specimens in Bartlett's collection do not tend to confirm this view, and the point requires further examination.

(100.) *IODOPLEURA ISABELLÆ*, Parz.

Both sexes and the young of this fine species are in the collection. The female is distinguished by the want of the violet side-tufts (as in *I. pipra*).

(106.) *CHLOROPIPO*, sp. — ?

A female, probably referable to a species of this genus. Sclater's collection contains a similar skin from Ecuador.

† (128.) *CHÆTURA BRACHYCERCA*, sp. nov. (Pl. XXXIV.)

Æneo-nigra: dorso inferiore uropygio et cauda tota cum tectricibus caudæ superioribus et inferioribus fusciscenti-cinereis; rectricum rachidibus acuminatis nigris: cauda brevissima: rostro et pedibus nigris: long. tota 4.0, alæ 4.6, caudæ 1.2, tarsi 0.4.

Hab. Peruv. orient. Xeberos (Bartlett).

This is a new and very distinct species of the small group of American *Chætura*, remarkable for its short tail. Mr. Bartlett's collection contains nine specimens of it, all from Xeberos. The sexes are alike.

(145.) *POLYTMUS LEUCORRHŒUS*, Gould.

See our remarks on this species (*anted*, p. 584). Many specimens of it are in the present collection.

† (153.) *PIAYA MEHLERI*, Bp.; Schlegel, Mus. d. P.-B. Cuculi, p. 57.

Piaya nigricrissa, Sclater.

It appears from Schlegel's recent researches that Sclater was mistaken in considering Bonaparte's type of *P. mehleri* referable to the Mexican form of this species (*cf.* P. Z. S. 1860, p. 285), and that the specimen in question was from Bogota. It follows, therefore, that this bird must be called *Piaya mehleri*.

† (154.) *PIAYA MELANOASTRA* (Vieill.).

Cuculus melanogaster, Vieill. N. D. viii. p. 236, et Enc. Méth. p. 1337.

Cuculus cayanus, var., Gm. S. N. i. p. 417.

Macropus caixana, Spix, Av. Bras. i. p. 54, t. 43.

Piaya brachyptera, Less. Trait. p. 140; Bp. Consp. i. p. 111.

P. melanogaster, Schlegel, Mus. d. P.-B. Cuculi, p. 59.

Pyrhococcyx brachypterus, Cab. in Schomb. Guian. iii. p. 714.

Several examples of this bird from Chyavetas. Mr. Eyton's collection contains a skin of the same species from Guia (*Wallace*).

† (169.) *CELEUS CITREOPYGIUS*, sp. nov.

Celeus citreopygius, Bp. MS.

Celeo-picus junana, Malh. Mon. Pic. ii. p. 27 (partim).

♂. *Luride badius: secundariis et interscapulio cum ventre imo et crisso castaneis: dorso postico aurantiaco: primariis extus et cauda nigricantibus: subalaribus citrino-flavis hand fascia-*

tis: macula mystacali coccinea: long. tota 12·0, alæ 6·0, caudæ 4·0, rostri a rictu 1·4.

Fœm. *Macula mystacali nulla.*

Hab. Peruv. orient. Yurimaguas (*Bartlett*).

We have already alluded to the existence of this species in our notes on the true *Celeus jumana* (Spix)*, with which it has hitherto been confounded. It is perhaps, however, strictly more nearly allied to *Celeus citrinus* than to *C. jumana*, having the under wings and underside of the primaries entirely unspotted, as in the former species.

Slater has a male specimen of this bird in his collection marked "*Celeus citreopygius*, Bp. MS.," which we accordingly adopt as its specific name. Malherbe's figure 1 (pl. 55) looks very like the present bird; but in his figure 3 and letterpress he clearly indicates the barred under surface of the primaries, which does not exist in this species†.

(180.) *UROCHROMA HUETI* (Temm.).

Psittacus hueti, Temm. Pl. Col. 491.

Urochroma hueti, Bp.

We were not previously acquainted with the true habitat of this beautiful species.

+ (189.) *MICRASTUR MIRANDOLLEI*.

Astur mirandollei, Schlegel, Ned. Tijdschr. i. p. 130, et Mus. d. P.-B. Astures, p. 27.

Micrastur macrorhynchus, Pelzeln, Reise d. Novara-Exp. Vögel, p. 11.

A single skin (marked female) from Chyavetas appears referable to this recently described species. Slater has lately seen in the Musée des Pays-Bas the typical example of Schlegel's *Astur mirandollei*, and has little doubt of its identity with Pelzeln's *Micrastur macrorhynchus*, a mounted skin of which, received from the Vienna collection, stands beside it. The present example agrees well with Pelzeln's description.

12. Notes on the Panolia Deer or Thamyn (*Cervus eldi*).

By Lieut. R. C. BEAVAN, C.M.Z.S.

Lieut.-Col. Blake, Commandant 9th Madras Native Infantry, has kindly furnished me with the following information concerning this Deer:—

"As regards the exact localities of the 'Thamyn,' I can only say

* *Antea*, p. 586.

† I have examined Malherbe's type-specimens of his *C. jumana* since the above was written, and found that one of them belongs to the true *C. jumana*, and the other to *C. citreopygius*. These specimens are now in the collection of M. Turati of Milan.—P. L. S.

where I have found them and where not. As far as I know they do not occur to the south of Moulmein; but from within a short distance of Thabyoo Point, the south-western headland of the Martaban district, to Sittang, bounded to the eastward by the forest line, they are found in large herds. Again, on the opposite side of the Sittang River, to the south and west of Pegu, they are also found in large numbers. How far they extend in a westerly and northerly direction, from the mouth of the Rangoon River, and in the Bassein district, I do not know; but I have heard that they are common even as high up as Munneepore.

"From Pegu to the north they are found in very small parties, the ground not suiting them until you cross the 'Koon' creek or river, the separating boundary between the Martaban and Thounghoo districts, and from this to within a few miles of Thounghoo they occur in large herds.

"Sometimes the plains or open spaces between the 'Eng*' forests will be covered with them, and three or four hundred may be seen at one time. Under these circumstances they are shy and very difficult to approach. Strange to say, although the ground appears quite as favourable for them, I have never seen a single one to the eastward of the Sittang River, north of Sittang. From the above you will see that in habits they are gregarious. During the night and early morning and evening they frequent the plains, and where the forest jungle is not distant they retire into it during the heat of the day.

"Their food, I imagine, consists of grass. I cannot call to mind having seen more than *one* fawn with its mother.

"The colour of the young, as well as that of the females, is what is termed light fawn-colour. The males are sometimes of the same, and sometimes as dark as the male of the Sambur (*Cercus hippelaphus*). I know not if any change takes place in their coats with the change of seasons."

Colonel D. Brown, Officiating Commissioner at Moulmein, has noticed them to range along both banks of the Irrawaddy, on the proper right bank up to Meanoung, and on the left bank as far as Meaday on the British frontier, N. lat. 19° 40', E. long. 95° 20' (approximately). He has also observed them as plentiful at Theegwen near Bassein, a few at Padoung opposite Promé, and more sparsely scattered through the Thanawaddy district.

For most of the following information I am indebted to the courtesy of J. Davis, Esq., Superintendent of Police in the Martaban district, an officer well known for his intimate acquaintance with the Burmese language; hence his services as interpreter were invaluable when Burmese and Karen shikarees had to be questioned.

Pioneered by him, early in October last, I visited the haunts of the Thamyn near Thatone (a town about forty miles north-west of Moulmein); and although, owing to the dense nature of the vegetation covering the plains at that time of year, I was only able to see

* *Dipterocarpus grandifolia*, Wall., "Wood-Oil-tree," Mason's 'Burmah,' edit. 1860, p. 493.

a few scattered females and young of the second year, yet the insight thus afforded into their habits and economy more than repaid me for the severe attack of illness I subsequently incurred by exposure to the heat and wet.

This plain of Yengyaing was then, owing to recent and heavy falls of rain, one large swamp. Nearly the whole of its unbroken extent, which embraces an area of fourteen miles in length with an average breadth of ten, could be traversed in a small canoe, except here and there where mud and vegetation combined obliged one to resort to a very unpleasant system of half wading in water and half sticking in deep slime. A continuation of this plain, broken here and there by belts of jungle, extends for several hundred miles up the Burmese coast, and has evidently been formed by the gradual retirement of the sea, which at one time doubtless dashed its waves against the Martaban and other continuous ranges of laterite hills. It is now, at Yengyaing, some eight to ten miles distant from the hills, and seems to be still retiring, since the water along the coasts of the Gulf of Martaban is very shallow, and studded here and there with sandbanks. For the primary cause of this we may doubtless look to the immense amount of silt brought down by the waters of the Salween, Beeling, Sittang, and Rangoon rivers, all of which discharge themselves into the Gulf of Martaban. As the sea retires, a belt of mangrove-jungle, about a mile in width, appears to travel with it, and the plain is thus enclosed by a barrier of vegetation on one side and the mountains on the other. This strip of mangrove-jungle gives cover to numberless Hog-deer, Tigers, Leopards, and Pigs, but is never entered by the Thamyn, except where somewhat open; nor on the other side do they ever attempt to penetrate into the mountains. The plain is intersected by numerous tidal creeks, which, in the hot weather, when deprived of water from the hills, appear to dry up to a great extent; and those still open at that time of year contain no admixture of fresh water, so that it is evident that for two, if not three, months in the year the Thamyn must be entirely deprived of fresh water*; whilst during the rainy season, for six months at least, they may be said to live in water. It appears wonderful how they can manage to exist in such extremes of heat and wet.

With the exception of a few stunted trees here and there, and a fringe of *Hibiscus* bushes along the creeks, the plain is covered with nothing but grasses and paddy, of which latter both the wild and cultivated varieties are abundant. Owing to the paucity of the population and the consequent demand for labour in this immediate neighbourhood, perhaps only one-fourth of the whole area is under cultivation for paddy; the crop succeeds here admirably, and the grain forms one of the staple articles of export from Moulmein and other Burmese ports.

The remaining three-fourths is covered with the indigenous uncultivated plant, which in seasons of scarcity is reaped and used for food. This forms a vast grazing-ground both for the Thamyn and

* The Burmese assert that during this period the animal drinks urine!

for large herds of tame Buffaloes, which are during the rains pastured here by the Karens, but withdrawn into the heavy jungles near the hills when in April and May the whole of the vegetation on the plain becomes parched up and devoured by jungle-fires.

At the time of my visit vast flocks of waders and other water-birds were arriving from the north, and the creeks were filled with Pelicans of several species, whilst the mud-flats absolutely swarmed with Stints, Sandpipers, Egrets, and especially the Rosy Tantalus. Here and there, stalking gravely amongst the flowering paddy, might be seen pairs of the Siris Crane (*Grus antigone*), or a troop of Adjutants, both of which birds breed in the neighbourhood. Occasionally the rarer Javan Adjutant was met with, and the Jabiru Stork (*Mycteria australis*).

The rutting-season of this Deer commences in the middle of March, and lasts throughout April to the middle of May. The female gestates nearly seven months, and brings forth her young amongst the jungle-paddy in October and November, the paddy being then flowering or in seed and at its greatest height. The female has only one young one at a time, which frequently stays with its mother until the second year*. The females have only four teats. In colour they are much like the female Sambur, but perhaps a little lighter. The young are at first spotted or mottled, but these markings disappear with age. The females are hornless. Both sexes begin to breed at about eighteen months old. The young males first begin to acquire horns in the second year†. After two years they get two tines, and when about seven years old are in their prime, with twelve tines (including the brow-antler). The colour of a full-grown buck is dark brown, especially about the back and neck, with underparts lighter. As far as I can ascertain there is no trace of a mane; and the texture of the coat varies considerably with the seasons. More exact information on these points is, however, needed.

The natives have a vague idea that two distinct species, "the lesser and the greater Thamyn," are to be found in the same herds, distinguishable only by differences of the size of the horns and of colour; but this of course is to be accounted for by the individual distinctions common to all races of animals. The horns are perfectly developed in March, and shed in the middle of the rainy season—that is, about September.

The average weight of the male is from 50 to 60 viss‡, that of a female 40 viss. Four men can carry a male with ease when disembowelled and quartered§. The male averages $3\frac{3}{4}$ feet in height at the shoulder; the female a little less. The very largest males do not exceed $4\frac{1}{2}$ feet in height.

The flesh is much liked by the Burmese, and always finds a ready sale in the neighbouring villages. The Karens, however, will not

* The mother will breed a second time eighteen months after bringing forth, so that the young of two seasons are not unfrequently seen with their parent.

† As noticed above by Blyth, on Major Tickell's specimen at Moulmein.

‡ A viss is equal to 140 tolaks.

§ As noticed by Blyth, the Burmese always quarter deer with the skin on.

eat the meat, because they think it will bring on cholera. It is rarely brought into Moulmein. In the country the wholesale price* of a doe is rupees 3, a buck is rupees 4, which is of course less than the usual retail bazaar rate. The flesh is said to smell a little about the end of March, when the weather is very hot; it is best for food about November and December.

The range of the Panolia Deer, according to Mr. Davis, is as follows:—In the Martaban district they inhabit exclusively the open grassy plains between the sea and the mountains. In the Pegu plains they are perhaps more abundant than in any other part of Burmah; next to these the Yengyaing plain in Martaban produces most; near Rangoon they are found in the Dallah plain. About Pegu and Yengyaing they are found in herds of from fifty to a hundred in the month of March; but when hunted they congregate much more, and as many as two hundred may then be seen together. In habits they are essentially gregarious, and associate with no other species, although Hog-deer abound in the grass and jungle along the edges of the plain; nor will they allow the tame Buffaloes to come nearer to them than about 100 yards. In habits they are very wary and difficult of approach, especially the males. They are also very timid, and easily startled; the males, however, when wounded and brought to bay with dogs get very savage and charge vigorously. On being disturbed they invariably make for the open, instead of resorting to the heavy jungle like Hog-deer and Sambur. In fact the Thamyn is essentially a plain-loving species; and, although it will frequent tolerably open tree-jungle, for the sake of its shade, it will never venture into dense or matted underwood—*i. e.* “bush-jungle,” in contradistinction to “tree-jungle.”

Indeed I was credibly informed of a large stag which, being driven into a corner of the plain last year by herd-boys with pariah dogs, and finding no means of escape, took refuge in heavy jungle, where its horns got entangled in an *Hibiscus* bush, and so was actually captured alive. Its captors, however, soon put an end to its existence with a sharp “dhar.”

When first started the pace of the Thamyn is great. It commences by giving three or four large bounds like the Axis or Spotted Deer, and afterwards settles down into a long trot, which it will keep up for six or seven miles on end when frequently disturbed. This is when the vegetation on the plain is comparatively short. In the rains they do not go far before they find a hiding-place in the long paddy. Their powers of leaping are highly developed. On the Yengyaing plain alone there are at the present time about a thousand head, on the Thatong plain, a little further to the north-west, perhaps a hundred head only, which go about in small herds of seven and eight. At Yengyaing the annual number killed amounts to about forty-five, including those bagged by Europeans; and about five natives gain their livelihood in that place almost entirely by the sale of its flesh. They are least gregarious in the rainy weather. The females have mostly then retired in twos and threes into quiet

* The price quoted is what a shikarry usually expects to realize.

spots, and the herds are altogether more scattered, owing to the increased density of the vegetation.

They feed both during the day and night, chiefly in early morning and evening. Their food consists principally of jungle-paddy; during the night they do a great deal of damage to the cultivated variety, treading down more than they eat. They also feed on grass, and the leaves of two jungle-trees called in Burmese the "*keay*" and the "*thameh*," the scientific appellations of which I am unable to resolve. In a tamed state they will eat plantain-leaves.

The call of the female uttered when disturbed is a short barking grunt, that of the males is louder and more prolonged. It is most frequently heard in the rutting-season, during which period the males have frequent and severe battles. A pair have been known to have been captured whilst so engaged with their antlers interlocked.

About the end of January the first jungle-fire sweeps over the plain and destroys the dry herbage, leaving small patches here and there about the edges of swamps. The second burning takes place about the end of March, and leaves scarcely a blade of grass behind it; the plain is then almost entirely bare, and the deer, having no cover, congregate in large herds. They are then to be seen on all sides, and, the Buffaloes having previously been withdrawn to the tree-jungle, are left alone in their glory, and, as noticed before by Colonel Blake, become at this time excessively wary. From the middle of February until the first showers fall at the end of April they apparently subsist without water; they lie in the salt-swamps during this period, and get the benefit of heavy dews at night.

Their only enemy appears to be man; but an epidemic occasionally breaks out amongst them and destroys large numbers. The last occurred in 1863, and some fifty or sixty head fell victims. The cause of this murrain is unknown; it is probably analogous to that which yearly in Burmah, during the rains, causes such havoc amongst domestic cattle. The Burmese readily eat the diseased flesh, and experience no bad effects from doing so. The disease attacks old and young alike, apparently, causes great emaciation and loss of strength, and the animal at last dies of pure weakness. It will probably be found to be some swelling or affection of the throat and lungs which prevents the animal from eating.

There seems to be no doubt that in Burmah this species is gradually decreasing, and will at no distant date be excessively rare. This can be accounted for by the gradual but steady increase in the population, and the greater area of country (which must naturally increase yearly) which is taken up for the cultivation of rice. Unfortunately for the Thamyn, the whole of their favourite *locale* is excessively well adapted to the cultivation of rice; and there is no doubt that where the indigenous wild plant is found there also the cultivated variety will flourish. The rice-trade of Burmah is yearly increasing in extent; and a few years bid fair to see the present haunts of the Thamyn not unlike the present state of the greater portion of the rice-producing plains of Lower Bengal.

*An intelligent Burmese shikarry, who has been a hunter from his

youth upwards and is now an elderly man, tells me that in former years, before Martaban was taken by the British, the Thamyn were much more abundant than they are now, and that the natives used to destroy them wholesale at battues. A large number of men would assemble from the surrounding villages, and gradually encircle three or four moderate-sized herds with long strings, upon which plantain-leaves were tied so as to flutter in the wind. The circle, originally formed at some distance, was gradually lessened as the deer, afraid to pass the scarecrows, got gradually driven together, until they were completely surrounded and at the mercy of the hunters. The object was to get them into a corner near the heavy jungle, into which, if they attempted to run, they either became entangled or allowed their pursuers to get up quite close. As many as 150 to 200, my informant tells me, he has himself seen killed in one battue in former years. To such a length was this system carried, and such enormous havoc was thereby created, that the Burmese Government, fearing the species would be utterly exterminated, wisely put a stop to the practice. This shikarry informed me that twenty-five years ago he has seen as many as 500 head in one herd; and his account was confirmed by others. At the present day vast mounds of their bones in every stage of decay exist on the Thatong plain, the site of many a battue in former times. The value of a whole carcass then was only 4 annas, or $\frac{1}{4}$ tical weight of Burmese silver, equivalent to 8 or 10 annas of our coinage at the present day! Several intelligent men are living now in the vicinity of Thatong and Yengyaing who formerly took part in these wholesale slaughterings, and, like many others of the present generation, are apt to look back fondly to those good old times.

These battues or kyówine were preceded by all sorts of ceremonies and sacrificial rites, offerings being previously made to ensure success to the tutelary nats or deities of the woods and plains.

In addition to these battues, and the recent increase of cultivation and population, we may account for their gradual decrease by the great increase that has taken place of late years in the number and use of firearms. Nearly every Burman can shoot, and a large proportion have each their matchlock or cheap gun.

It is excessively difficult to catch the Thamyn alive, even a young one, owing to the open nature of the country they frequent; and several officers in the Burmese commission have for some time past been endeavouring, without success, to procure young individuals of both sexes for the Zoological Society of London. Major Tickell, as narrated by Blyth, had one alive for some time in Moulmein; but it was eventually killed by pariah dogs, who got into its enclosure at night. My informant, the shikarry, tells me he had one also tame some years since. He caught it when about three months old, fed it on milk at first, afterwards on grass and plantain-leaves. After a short time it became so tame that it would follow its owner about, and never attempt to leave the dwellings of man. After an interval of two years it got a small pair of horns, shaped like those of the adult, but much smaller, and afterwards, like most

pets, met with an untimely end, being stolen and killed for food by rapacious Burmese officials. By this the species appears to be capable of easy domestication, although said by some invariably to pine away and die after capture.

The horns of the species are, if large, kept by the natives for making handles for sickles; if small, they are of no value, and either thrown away or cut up and used as pegs. As to medicinal qualities, when a buffaloe is bitten by a snake, the horn of the 'Thamyn ground to powder is mixed with a solution of the leaves of the "yekazon" (*Ipomœa*, sp.), or wild convolvulus, and given internally as a dose. It is said to cure the bitten animal immediately. No other part of the beast appears to be used medicinally, and the above-mentioned nostrum is of no avail for the human race.

13. Notes on the Myology of *Iguana tuberculata*. By ST. GEORGE MIVART, F.L.S., Lecturer on Comparative Anatomy at St. Mary's Hospital.

The muscles of Saurian Reptiles (in which group I by no means include the *Crocodylia*) have not hitherto, as far as I know, been described in any detail, and have scarcely at all been figured. Many facts have certainly been recorded by Meckel*; and Heusinger† has also published interesting notices (mainly referring, however, to those forms in which the limbs are rudimentary); but the greatest and most accurate record of saurian myology as yet accessible is that given in the second part of Professor Stannius's new edition of his 'Anatomy of the Vertebrata'‡.

It has been suggested to me that a series of notices, accompanied by woodcuts, of the main peculiarities presented by the myology of different oviparous vertebrates would be a not undesirable contribution to comparative anatomy; and I have now the honour of laying before the Zoological Society the results of my dissection of a fine specimen of *Iguana tuberculata*, for the opportunity of making which I am indebted to the rich stores of the collection of the Royal College of Surgeons, and to the kindness of my friend Mr. W. H. Flower.

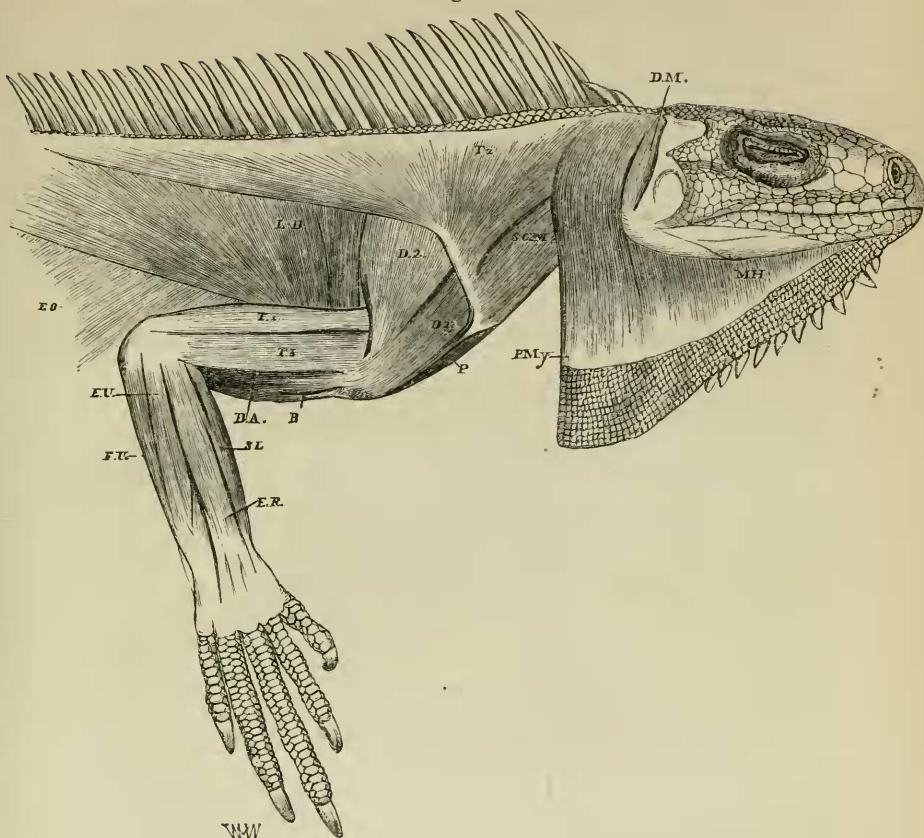
A correct determination of Saurian muscles, especially those of the posterior extremity, is not to be hoped for in a first attempt. I have therefore thought it well to begin with the Iguana, because it is a common species, readily procurable, on which account my errors and misinterpretations will be the more easily rectified.

* *Traité général d'Anatomie comparée*, par J. F. Meckel: traduit de l'allemand par MM. Riester et Alph. Sanson (Paris, 1829): tome v. 1^{re} partie, et tome viii.

† In *Zeitschrift für organ. Physik*. Bd. iii. Hft. 5. p. 481.

‡ *Handbuch der Zootomie*, von Siebold und Stannius. Zweiter Theil. Die Wirbelthiere. Zweite Auflage. Zweites Buch. Die Amphibien (Berlin, 1856), pp. 100, 117, 122, 126, 133.

Fig. 1.



Superficial muscles of outer side of thorax and arm, and of extensor surface of forearm,—the gular pouch being cut to show more of the sterno-cleido-mastoid.

B. Biceps. *B. A.* Brachialis anticus. *D. 1.* First part of deltoid. *D. 2.* Second part of deltoid. *D. M.* Depressor mandibulae. *E. O.* External oblique. *E. R.* Extensor carpi radialis. *E. U.* Extensor carpi ulnaris. *F. U.* Flexor carpi ulnaris. *L. D.* Latissimus dorsi. *M. H.* Mylo-hyoid. *P.* Pectoralis major. *P. My.* Platysma myoides. *S. C. M.* Sterno-cleido-mastoid. *S. L.* Supinator longus. *Tz.* Trapezius.

MUSCLES OF THE HEAD AND TRUNK.

Mylo-hyoid (fig. 1, *M. H.*). This is a thin muscular layer, arising from the outside of the posterior part of the mandible and from the inferior margin of the middle and more anterior portion of the bone. It does not, however, extend to its anterior end. Descending inside the skin of the gular pouch its fibres gradually become lost.

Fibres similarly disposed below, but ending above in the fascia

covering the trapezius, constitute a more posterior layer of superficial fibres having no connexion with the mandible; these may perhaps represent the *platysma myoides* (fig. 1, *P. My.*).

On removing the *mylo-hyoid* a muscle becomes visible which is of rather large size, and descends from the middle of the lower border of the inner surface of the mandible to the cornu of the os hyoides. This is the *cerato-mandibular* (fig. 2, *C. M.*).

The *depressor mandibulæ*, which may perhaps represent the digastric (figs. 1, 2 & 2A, *D. M.*), arises from the posterior margin of the parietal process. Descending, it is inserted into the extreme posterior end of the mandible.

The *temporal* muscle is very thick and large, and fills the temporal fossa. It arises from the outside of the parietal process and from the front surface of the os quadratum*. It is inserted into the coronoid process of the mandible, and into the upper border of the bone behind that process.

Internal pterygoid. This large, thick muscle takes origin from the inner side of the pterygoid, and is inserted into the inside and posterior extremity of the mandible.

The *external pterygoid* arises outside the pterygoid, and is inserted into the inner surface of the mandible rather in front of the insertion of the internal pterygoid and behind the coronoid process.

Trapezius (figs. 1 & 2, *Tz.*). This muscle, as Meckel observes†, is very extensive. It lies beneath the *platysma myoides*, but superficial to the levator claviculæ; and the lowest part of its insertion overlaps that of the omo-hyoid (fig. 2, *Tz.*, *O. II.*). It forms a very delicate muscular layer, especially above, but becomes thicker towards its insertion. It arises, by aponeurosis, from the middle line of the back, from the last cervical to the fifth dorsal vertebra, and more anteriorly from the superficial fascia of the neck, and also from the margin of the parietal process, towards which part it is intimately united to the sterno-cleido-mastoid. The fibres converge, and are inserted into about the upper half of the clavicle between the deltoid and the insertions of the levator claviculæ, omo-hyoid, and sterno-cleido-mastoid. The most anterior and posterior fibres antagonize each other.

The *rhomboid* is wanting, unless it be represented by some part of the muscle described as the *serratus magnus*.

Latissimus dorsi (figs. 1 & 9, *L. D.*). This is a large muscle, and arises from the spines of the dorsal vertebræ from the first to the ninth, and from the last three cervical spines. Its fibres, converging, end in a strong tendon, which is inserted into the outer side of the summit of the humerus below, passing rather in front of, the insertion of the infraspinatus, covered moreover by the third head of the triceps. The tendon of the latissimus dorsi gives off another small tendon from its inferior margin (fig. 9, *t.*), which joins the triceps just where the two long heads of that muscle unite together.

* The part arising from the os quadratum and columella is considered by Stannius to be the *masseter*.

† *Loc. cit.* p. 311.

Longissimus dorsi. This is small and very indistinctly separable from the sacro-lumbalis. It partly arises from the posterior end of the crest of the ilium; partly it is the anterior continuation of the dorsal series of caudal muscular cones, or rather to the halves of those cones. Passing forwards it is inserted into, and takes fresh origin from, the spines and adjacent parts of the vertebræ.

The *sacro-lumbalis*, though wide, is very thin, except at its posterior end, and it is very imperfectly separable from the last. It arises from the crest of the ilium, and appears to be partly continuous with the supracaudal muscular mass. It is inserted, in an indistinct manner (by tendinous intervals which become more marked from behind forwards), into the ribs, including the cervical ones, as it passes insensibly into the *cervicalis ascendens*.

Complexus major (figs. 2 & 2A, *C. Ma.*). This is an elongated muscle arising by tendinous fibres from the spines of the first and

Fig. 2.

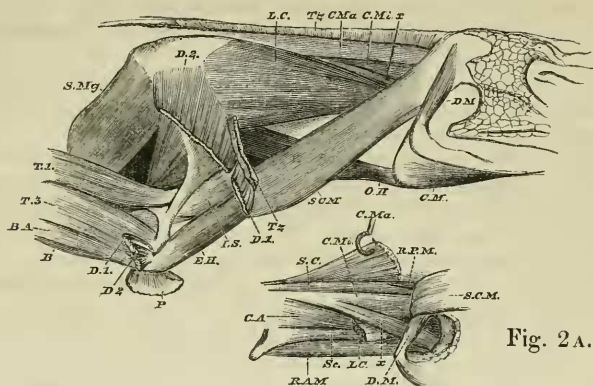


Fig. 2A.

Fig. 2.

Muscles of neck and shoulder, the trapezius and deltoid being cut short.

- B.* Biceps. *B. A.* Brachialis anticus. *C. M.* Cerato-mandibular. *C. Ma.* Complexus major. *C. Mi.* Complexus minor. *D. 1.* First part of deltoid. *D. 2.* Second part of deltoid. *D. M.* Depressor mandibulæ. *E. H.* Epicoraco-humeral. *I. S.* Infraspinatus. *L. C.* Levator claviculæ. *O. H.* Omo-hyoid. *P.* Pectoralis. *S. C. M.* Sterno-cleido-mastoid. *S. Mg.* Serratus magnus. *T. 1.* External long head of triceps. *T. 3.* External humeral head of triceps. *Tz.* Trapezius. *x.* Fasciculus from complexus minor. The muscle between *D. 2.*, *S. Mg.*, and *T. 1.* is the subscapularis.

Fig. 2A.

Deeper muscles of right side of neck, the levator claviculæ being cut short, the sterno-cleido-mastoid cut and reflected forwards, and the complexus major cut and raised.

- C. A.* Cervicalis ascendens. *C. Ma.* Complexus major. *C. Mi.* Complexus minor. *D. M.* Depressor mandibulæ. *R. A. M.* Rectus capitis anticus major. *R. P. M.* Rectus capitis posticus major. *Sc.* Scalenus. *S. C. M.* Sterno-cleido-mastoid. *x.* Fasciculus from complexus minor.

second dorsal vertebræ, and from the transverse processes of the last four cervical vertebræ. It is inserted into the supraoccipital and into the parietal process.

Complexus minor (figs. 2 & 2A, C. Mi.). A muscle placed externally to the last arises from the transverse processes of the last four cervical vertebræ. It is inserted, by strong tendinous fibres, into the end of the parotic process, but gives off from its outer side a fasciculus (figs. 2 & 2A, x) which passes to the postero-external end of that depending process of the basioccipital which bounds internally the posterior part of the eustachian aperture.

Cervicalis ascendens. This (fig. 2A, C. A.), as has been said, is the continuation forwards of the sacro-lumbalis. It is inserted by tendinous fibres into the outer sides of the cervical ribs and into the transverse processes of the four anterior cervical vertebræ (including the atlas), which have no ribs.

Spinalis colli (fig. 2A, S. C.). The innermost portion of the deep part of the dorsal extensor mass fills the groove between the spinous and articular processes of the cervical vertebræ. It ends at the occiput, where it enters the deep fossa between the supraoccipital and the diverging parietal processes.

Rectus capitis posticus major. A more or less distinct muscular fasciculus (fig. 2A, R. P. M.) arises from the spinous process of the axis, and is inserted into the supraoccipital.

Scalenus. The scalene muscles appear to be represented by a very obscurely separable small muscular mass, which extends from the transverse processes of the first four cervical vertebræ to the anterior margin of the first cervical rib. It lies between the cervicalis ascendens and the rectus capitis anticus major (fig. 2A, Sc.).

The *longus colli* arises from the ventral surfaces of the bodies of the atlas and two following cervical vertebræ. It is inserted into the same surfaces of the next four cervical vertebræ and into the last three cervical ribs near their origins.

Rectus capitis anticus major (fig. 2A, R. A. M.). This muscle arises from the posterior end of the under surface of the basioccipital, and largely from the process bounding internally the posterior end of the eustachian aperture. Passing backwards it is inserted into the bodies of the cervical vertebræ from the fourth to the seventh inclusive, and finally into the anterior margin of the deep surface of the rib of the seventh cervical vertebra.

Rectus abdominis. The abdominal muscles are largely developed, both as regards superficial extent and number, as there appear to be no less than three layers of the external oblique muscle. The *rectus* is broad, but rather ill-defined superficially as to its outer margin, which, however, is readily seen on its internal surface. It arises by a strong tendon from the posterior end of the ventral surface of the symphysis ischii (figs. 13 & 14, R.). Thence it runs forwards along the middle line of the belly, and is inserted into the posterior margin of the last sternal rib, whence it is continued to the last sternal rib but one, where it is conterminous with the pectoralis major (fig. 6, R.), which is apparently its anterior prolongation.

The lateral superficial margins of the muscle are indistinguishably blended with the external oblique, which sends oblique tendinous fibres right across the superficial surface of the rectus.

External oblique. This muscle seems to consist of three parts* :—

(1) The most superficial portion arises by tendinous interdigitations with the dorsal extensor muscles, from the last cervical and all the thoracic ribs. It is a very delicate layer, and ends below by blending with the upper margin of the rectus, with which it becomes inseparably united. It is also inserted (by a tongue of muscular fibres) just above the very strong tendon of insertion of the third portion. It has five tendinous intersections.

(2) The second part arises, beneath the first, by less marked digitations from all the thoracic ribs. Passing downwards and backwards, its most anterior portion is strongly inserted into the fifth thoracic rib; elsewhere it ends in a delicate aponeurosis, which is connected with the sixth thoracic rib, and blends with the inner surface of the first or most superficial layer of the muscle.

(3) The third part of the *external oblique* (fig. 1, *E. O.*, and fig. 13, *Ex. o.*) arises from the posterior surface of the last thoracic rib and from the lumbar fascia. It is inserted, by a very strong tendon, into the spine of the pubis.

This muscle appears to continue backwards the upper, or external, intercostals.

The *internal oblique* is of great extent, lining the whole of the thorax. It arises from the inner surfaces of all the thoracic ribs, beginning by a tendinous aponeurosis which is attached to them along a line nearly corresponding to the outer edge of the dorsal extensor muscular mass. It also takes origin from the lumbar fascia just behind the third part of the external oblique. It is inserted by muscular digitations into the inner surfaces of the sternal ribs and (in the abdomen) into the margin of the rectus.

This muscle is evidently not continuous with the internal (or sternal) *intercostals*, as these are superficial to the fleshy insertions of the internal oblique, the fibres of which, moreover, run more parallel to the sternal ribs themselves than do the fibres of the internal *intercostals*.

Transversalis. This muscle is also very extensive, arising by a fascia extending from the pelvis to the last but one cervical rib. Indeed the fascia is continued on into the neck, where it passes beneath the nerves of the brachial plexus, which are external to it, like the abdominal nerves which pass between it and the internal oblique. It is inserted into the border of the *rectus* and the inner sternal part of the thorax.

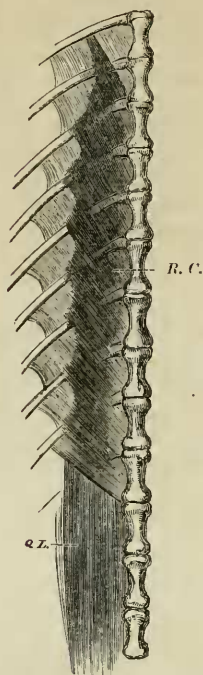
Internal intercostals. These extend between the sternal thoracic ribs, reaching vertically to the vertebral ribs, and underlying for some distance the external intercostals.

External intercostals. The external ones extend between the cervical ribs, as well as those of the trunk. In the thorax they only

* Stannius considers that the external oblique and internal oblique each consist of two layers (*loc. cit.* p. 104).

extend down to the junction of the vertebral ribs with the sternal ones.

Fig. 3.



Subvertebral muscles of right side.

Q. L. Quadratus lumborum. *R. C.* Retrahentes costarum.

Retrahentes costarum. A very remarkable muscular layer* (fig. 3, *R. C.*), which is tendinous at its insertion and at the posterior part of its origin, but muscular elsewhere. It has a certain resemblance to the diaphragm, as it is internal to all the other body-muscles.

It arises from the sides of the ventral surfaces of the bodies of nine vertebræ, beginning with the first dorsal. The muscular fibres proceed forwards and ventrad, and are inserted into the ribs of the seventh and eighth cervical vertebræ, and into the seven following ribs. The insertion of the aponeurosis is close to the origin of the fascia of the transversalis†.

Pyramidalis (fig. 14, *Py.*). This muscle is largely developed, and is placed beneath the rectus. It arises from the ligamentous arch extending back from the spine of the pubis; and its fibres ad-

* The *m. retrahentes costarum* of Stannius (*loc. cit.* p. 103).

† As Stannius remarks (*loc. cit.* note 4 to p. 103).

vance obliquely forwards towards the middle line of the body, those arising most anteriorly being the longest. The muscle extends forwards more than halfway from the pubis to the sternum.

Transversus perinei (fig. 14, *T. Pr.*). This is a thick triangular muscle, arising from the side of the os cloacæ and from the tendinous arch before mentioned passing to the ilium. It fuses more or less completely with the posterior part of the origin of the semimembranosus.

CAUDAL MUSCLES.

The essential nature of the *true* caudal muscles is best seen at about the middle of the tail (fig. 4). There the muscular mass of each lateral half of the tail, is easily demonstrated to consist of four longitudinal series of muscular and tendinous cones, the series being placed one above another, and all the cones having their apices directed forwards.

Fig. 4.

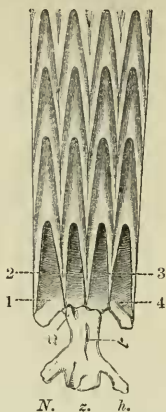


Diagram of caudal muscular cones of the right side of the tail.

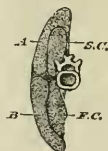
1. Dorsal lateral cone. 2. Upper median lateral cone. 3. Lower median lateral cone. 4. Ventral lateral cone. *h.* Inferior spine. *N.* Neural spine. *t.* Transverse process. *z.* Zygapophyses.

Four such cones appear to spring from each side of each caudal vertebra; but their length generally exceeds that of two such vertebrae. The base of each cone is aponeurotic, with the superficial part glisteningly tendinous. The apex of each cone is muscular. Each cone being hollow, it receives into its cavity the muscular apex of the cone next behind. The repetition of this serial enclosure gives rise to the four longitudinal rows of cones; and as the aponeurosis of each cone is more or less incomplete on its external surface, the tendinous margins of the aperture appear as two glistening lines, which converge anteriorly; moreover, the bases of the cones being on the same vertical line, the appearance of numerous acutely zigzag

lines results, four points being directed forwards and three backwards (fig. 4, 1, 2, 3, 4). Of the four vertically superimposed cones of each vertebra, the topmost one, or the dorsal lateral cone (fig. 4, 1), arises from the neural spine (*N.*) and the zygapophysis (*z.*). The cone next below, or the upper median lateral cone (fig. 4, 2), takes origin also from the zygapophysis; but below from the transverse process or (in more posterior caudal vertebræ) from the strong fascia which takes its place (*t.*). The next cone below, or the lower median lateral cone (fig. 4, 3), arises from the same transverse process or fascia and from the root of the inferior spinous process. The lowest, or ventral lateral cone (fig. 4, 4), springs from (*h*) the inferior spinous process itself.

This arrangement continues forwards to about the fourteenth caudal vertebra. Then the bases of the cones become excluded from the articular processes and from the roots of the hæmal spines by the intrusion and backward prolongation of a *supracaudal* muscular mass coming from the trunk (the *sus-caudien externe* of Meckel, vol. v. p. 284), and by that of the *femoro-caudal* below (fig. 5, *S. C.* and *F. C.*); so that the series of cones, being thus modified, come to form a muscular sheath for these intruding muscles, the sheath being strongly attached still to the ends of the transverse processes and of the neural and hæmal spines.

Fig. 5.



Muscles of right half of a transverse vertical section of the tail at the seventh caudal vertebra, showing the separation of the caudal cones from the vertebra by the intrusion of the supracaudal above and of the femoro-caudal below.

A. Superior lateral caudal cones. *B.* Inferior lateral caudal cones.
F. C. Femoro-caudal. *S. C.* Supracaudal.

The two series of median lateral cones more and more approximate as they approach the trunk, and, ultimately coalescing, are inserted strongly into the first caudal transverse process (fig. 15, *x*).

The dorsal lateral cones, much modified, continue on as the *longissimus dorsi*.

The ventral lateral cones terminate mainly by a very strong tendon implanted into the posterior end of the tuberosity of the ischium (close to the origins of the two parts of the semimembranosus), a portion, however, running on into a *sphincter cloacæ* *.

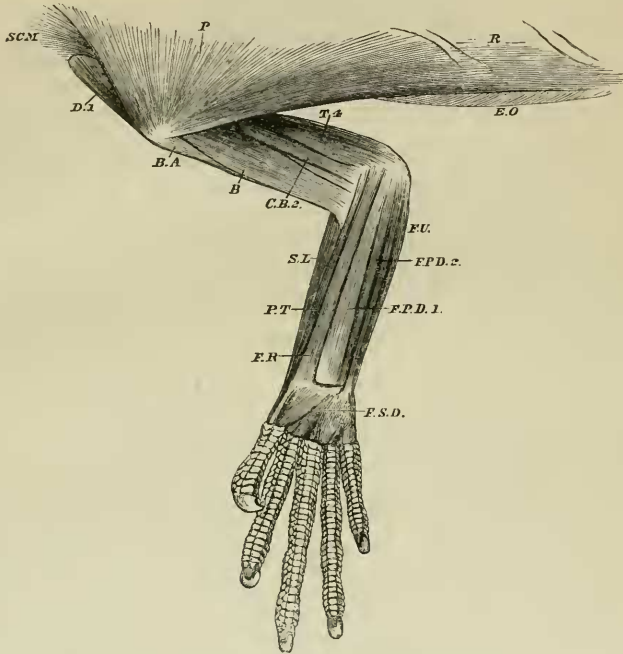
Of the intruding muscular masses the femoro-caudal, inserted into the femur, extends for about one-sixth of the length of the tail, as Meckel says†, or to about the thirteenth caudal vertebra.

* Meckel, *loc. cit.* p. 285.

† *Loc. cit.* p. 286.

The dorsal mass or *supracaudal* muscle is in part the continuation backwards of the sacro-lumbalis, in part takes fresh origin from the posterior surface of the ilium. It extends backwards also to about the thirteenth caudal vertebra.

Fig. 6.



Superficial muscles of front of thorax, of inside of right arm, and of flexor surface of right forearm.

- B.* Biceps. *B. A.* Brachialis anticus. *C. B. 2.* Second or long part of coracobrachialis. *D. 1.* First part of deltoid. *E. O.* External oblique. *E. U.* Extensor carpi ulnaris. *F. P. D. 1.* First part of flexor profundus digitorum. *F. P. D. 2.* Second part of flexor profundus digitorum. *F. R.* Flexor carpi radialis. *F. S. D.* Flexor sublimis digitorum. *P.* Pectoralis. *P. T.* Pronator teres. *R.* Rectus abdominis. *S. C. M.* Sternocleidomastoid. *S. L.* Supinator longus. *T. 4.* Fourth part of the triceps.

MUSCLES OF THE PECTORAL LIMB.

Pectoralis major (figs. 1, 2, 6, 8 & 10, *P.*). This muscle is largely developed, and arises from the sternal part of the sixth thoracic rib, and from the sternum and interclavicle, from the posterior end of the former to the anterior extremity of the latter.

From this extensive origin its fibres converge, and are inserted into the most prominent part of the radial tuberosity of the humerus, just opposite the insertion of the deltoid, but separated from the

latter by the summit of the brachialis anticus and by the insertion of the epicoraco-humeral. Externally the pectoralis major is intimately connected with the outermost layers of the external oblique, while posteriorly, as Meckel remarks*, it is similarly united with the rectus abdominis, of which, indeed, it has every appearance of being the anterior continuation.

Costo-coracoid (figs. 7 & 9, C. C.). A thin sheet of muscular fibres arises from the anterior margin of the first sternal rib, and is inserted into the deep surface of that strong tendon which is described below as in part the origin of the internal long head of the triceps. This tendon passes from the posterior end of the inner surface of the sternum (close to the hinder end of the edge by which it articulates with the coracoid), upwards to the anterior border of the scapula, between the spinous process projecting from that border and the point of attachment of the clavicle, and dividing the anterior (or lower) part of the subscapularis from its posterior portion.

This muscle answers no doubt to that which, in the *Echidna*†, goes from the first rib to the coracoid; for I have found such a muscle in *Alligator lucius*, and it is noticed by the Rev. Dr. Haughton in the *Crocodylus*‡ under the name "*pectoralis secundus*"—a term I would readily adopt, but that I am inclined to think that the muscle may be the homologue of either the pectoralis minor or the subclavius. Stannius§ speaks of it as the sterno-scapular; but this name has been applied to a muscle widely different||.

Serratus magnus and *levator anguli scapulæ* (figs. 2 & 7, S. Mg.). Several small sheets of muscle proceed from certain ribs to the posterior margin and inner surface (towards the superior margin) of the scapula. These may perhaps include, besides the true serratus magnus, not only the *levator anguli scapulæ*, but also the *rhomboideus*, though I am inclined to regard the latter muscle as absent in the *Iguana*, not having succeeded in finding the muscle which Meckel speaks of¶ as having the same disposition in that animal as in the Chameleon, though absent in *Polychrus marmoratus*.

There appear to be four principal portions of this complex muscle:—

(1) The largest and most posterior portion arises from the outer surfaces of the last two cervical ribs (*i. e.* those of the eighth and ninth cervical vertebræ) near their free ends. Each rib gives rise to a distinct muscular layer; and these layers are inserted, in common, into about the upper half of the posterior (or axillary) border of the scapula (fig. 7, S. Mg. 1). At the lower end of its insertion it is slightly embraced by fibres of the subscapularis, a few of which arise externally to it.

* *Loc. cit.* p. 343.

† *Trans. Linn. Soc.* 1866, vol. xxv. p. 382.

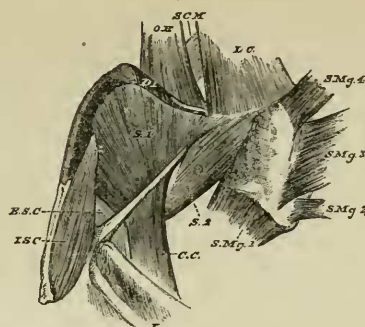
‡ Scientific papers read before the Royal Irish Academy, and published in its 'Proceedings,' 1866, vol. i. p. 702.

§ *Loc. cit.* p. 122.

|| *Proc. Zool. Soc.* 1865, p. 338, and 1866, p. 398 and figs. 2 & 3, S. s.

¶ *Loc. cit.* p. 312.

Fig. 7.



Muscles of the inside of the right half of the scapular arch.

C. C. Costo-coracoid. *D. 1.* First part of deltoid, curving over anterior (upper) margin of coracoid. *E. S. C.* External sterno-coracoid. *I. S. C.* Internal sterno-coracoid. *L. C.* Levator claviculae. *O. H.* Omo-hyoid. *S. 1.* First part of subscapularis. *S. 2.* Second part of subscapularis. *S. C. M.* Serratus-cleido-mastoid. *S. Mg. 1-S. Mg. 4.* Four parts of serratus magnus.

(2) The second and smallest portion (and which some might take to represent the *rhomboideus*) arises from the last but one cervical rib, but considerably higher up than the first portion of the serratus magnus. It is inserted (fig. 7, *S. Mg. 2*) into the inner surface of the posterior (inferior) vertebral angle of the scapula.

(3) The third portion arises from the outside of the ribs of the sixth and seventh cervical vertebrae. It is inserted (fig. 7, *S. Mg. 3*) along the inside of the cartilaginous summit of the scapula, not far from its vertebral margin, and extending along the greater part of the extent of that margin. This portion is double at its origin, each rib giving rise to its own layer of muscle; but the two have a common insertion.

(4) The fourth part of the serratus magnus springs from the outside of the seventh cervical rib, below the origin of the third portion of the serratus. It is inserted (fig. 7, *S. Mg. 4*) into the inner side of the cartilaginous part of the scapula close to the anterior (superior) vertebral angle, between the most anterior parts of the origin of the subscapularis and of the insertion of the third portion of the serratus.

Deltoid (figs. 1, 2, 7 & 8, *D. 1* and *D. 2*). This muscle is very large, and, in the specimen examined by me*, is easily separable into two parts, which, however, have a common insertion:—

(1) The lower portion consists also of two layers, superimposed one on the other,—the superficial layer arising from about the lower (or sternal) half of the posterior part of the deep surface of the clavicle, and from a similar extent of the hinder border of that bone, posterior to the attachments of the trapezius, omo-hyoid, and sterno-

* This was not the case in Meckel's specimen (*loc. cit.* p. 340).

cleido-mastoid. The deeper layer of the same part of the deltoid springs from the anterior part of about the sternal third of the superficial surface of the clavicle, and just in-front of the attachment of the two last-mentioned muscles, which, passing forwards, hide it. It then curves over the anterior margin of the clavicle, and passing backwards, between that bone and the epicoracoid, appears to join the first or more superficial layer.

When the scapular arch is looked at from within, this layer is visible (fig. 7, *D. 1*) immediately above the lower (anterior) portion of the subscapularis, and nearer the observer than the omo-hyoid and sterno-cleido-mastoid muscles.

(2) The upper and larger portion of the deltoid arises from the deep surface and posterior border of the clavicle for rather more than its upper third, and from the outer surface of the scapula for the whole extent between the lower part of the attachment of the levator claviculæ and the hinder (or axillary) margin of the bone. It does not extend upwards to the superior margin of the cartilaginous upper portion of the scapula (fig. 2, *D. 2*),—that part presenting externally a space to which no muscle is attached between this upper or second portion of the deltoid, the serratus magnus, and levator claviculæ.

The two parts of the deltoid are together inserted into the outer side of the radial tuberosity of the humerus, just opposite to the insertion of the pectoralis major, but separated from that muscle by the insertion of the epicoraco-humeral.

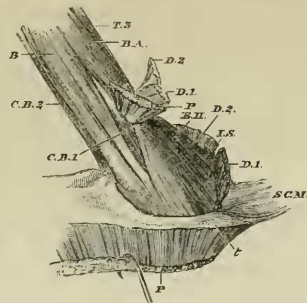
Infraspinatus (?). This rather small muscle (fig. 2, *I. S.*) arises from the outer surface of the spinous process of the scapula, and from the membrane intervening between that process and the first or upper spur of the epicoracoid; it takes origin almost down to the margin of the glenoid cavity. Thence it passes downwards in front of the long head of the triceps, and is inserted into the outer side of the humerus just below the head of the bone and between the summits of the external and internal humeral heads of the triceps. Its insertion is mainly superior to that of the latissimus dorsi, though the tendon of the latter slightly overlaps it.

The infraspinatus is as it were strapped down by a strong ligamentous band, which passes from the lower part of the axillary margin of the scapula to the outside of the head of the humerus, underneath the epicoraco-humeral and above the insertion of the deltoid.

The *epicoraco-humeral* is very largely developed, and arises from the two spurs of the epicoracoid and from the intervening membrane which closes the fenestra. It is inserted (figs. 2, 8 & 10, *E. II.*) into the summit of the radial tuberosity between the insertions of the pectoralis major and deltoid. It is covered externally by the lower part of the deltoid and by the pectoralis major; and its inferior margin is much connected with the adjacent part of the coraco-brachialis.

This muscle appears to me to answer to that which I have called by the same name in the *Echidna* (Trans. Linn. Soc. vol. xxv. 1866, p. 383, and pl. 52. fig. 2, *E. II.*).

Fig. 8.



Muscles of inside of right arm, the pectoralis and deltoid being cut short and reflected.

B. Biceps. *B. A.* Brachialis anticus. *C. B. 1.* First, or short, part of coraco-brachialis. *C. B. 2.* Second, or long, part of coraco-brachialis. *D. 1.* First part of deltoid. *D. 2.* Second part of deltoid. *E. H.* Epicoraco-humeral. *I. S.* Infraspinatus. *P.* Pectoralis. *S. C. M.* Sterno-cleido-mastoid. *T. 3.* Third, or external humeral, head of triceps. *t.* Tendinous fascia of origin of sterno-cleido-mastoid extending, between epicoraco-humeral and pectoralis, backwards to the true sternum.

Subscapularis. This muscle is enormously developed, and is divisible into two parts (fig. 7, *S. 1* and *S. 2*):—

(1) The first portion arises from the whole internal surface of the coracoid and epicoracoid, the spinous process of the scapula, and the membrane of each fenestra. The fibres converge, and towards its insertion this portion fuses with the second part.

(2) The second portion arises from the lower part of the internal surface of the scapula and from the lower half of its posterior, or axillary, margin. It becomes tendinous towards its insertion, and, fusing with the first part, is attached to the ulnar tuberosity of the humerus and to the capsular ligament. This muscle is shown in fig. 2 (though its letter has been accidentally omitted), between *D 2*, *S. Mg.*, *T. 1*, and the band binding down *I. S.*

Internal sterno-coracoid (fig. 7, *I. S. C.*). The specimen examined by me had had the whole ventral surface of the body medianly divided from behind forwards, so that I cannot define the inner limit of this muscle. It arises, however, from the deep surface of the sternum, internal to the line of its junction with the coracoid and to the attachments of the ribs, and is inserted, by tendinous fibres, into the deep surface of the coracoid and lower part of the epicoracoid (*i. e.* to the deep surface of its lower spur), where it is contiguous to the inferior margin of the first portion of the subscapularis.

External sterno-coracoid (fig. 7, *E. S. C.*). This is a much smaller muscle than the preceding, which overlaps it when the inner surface of the scapular arch is looked at. It arises from the deep margin of that furrow (on the outer edge of the sternum) which receives the coracoid, and is inserted into the coracoid and epicoracoid, passing between those bones and the tendon of the internal sterno-coracoid.

The *sterno-cleido-mastoid* is of large size (figs. 1, 2, 2A, 6 & 8, S. C. M.). It arises by muscular fibres from rather more than the lower half of the outer margin of the anterior surface of the clavicle, and by a very strong tendinous fascia (fig. 8, *t.*) from the anterior part of the true sternum. This strong fascia extends forwards (covered by the pectoralis major); and the muscular fibres springing from it arise in a point between the pectoralis major and the lower portion of the deltoid. The muscle passes forwards, overlapping first the omo-hyoid, and afterwards the levator claviculæ. It then becomes intimately united with the outer side of the anterior part of the trapezius, and is inserted into the outer half of the postero-superior margin of the parietal process and into the postero-external end of the parotic process.

Sterno-hyoid. This was so much injured in my specimen that I am unable to describe it; according to Cuvier* and Meckel†, however, it proceeds from the outer part of the sternum to the os hyoides.

The *omo-hyoid* (figs. 2 & 7, O. II.) is rather large, and arises from rather more than the upper half of the clavicle, where externally it is adjacent to the trapezius and sterno-cleido-mastoid and internal to the deep layer of the first part of the deltoid. It is mainly inserted into the posterior cornu of the hyoid; but some fibres pass (nearer the middle line of the body) to the body of the os hyoides.

Levator claviculæ. This large muscle has a strong tendinous origin from the transverse process of the atlas. Passing backwards it emerges from beneath the sterno-cleido-mastoid (figs. 2 & 7, L. C.), and, spreading out, is inserted into the summit (or acromial end) of the clavicle and into the anterior margin of the scapula. About the lower half of its insertion is conterminous, posteriorly, with the origin of the upper (or second) portion of the deltoid; internally this muscle is in close juxtaposition with the second part of the subscapularis and the fourth part of the serratus magnus (fig. 7, L. C.).

The *triceps* (figs. 1, 2, 6, 8, 9 & 10) arises by four distinct heads‡, of which two are long, descending from the scapular arch:—

(1) The first part or external long head (which appears to answer to the ordinary long head of this muscle in mammals) arises from the strong, tendinous strap, or ligament before described as passing from the axillary margin of the scapula to the head of the humerus and as binding down the infraspinatus. Thus the head may be said to arise by a bifurcating tendon like that of the rectus femoris of Man (figs. 1, 2 & 9, T. 1).

(2) The second part, or internal long head (fig. 9, T. 2), takes origin by a long and rather slender tendon, which also bifurcates above,—its lower bifurcation being attached to the postero-internal angle of the deep surface of the coracoid, while its upper bifurcation fuses with that before-described tendinous arch into which the costo-coracoid muscle is inserted.

This second head of the triceps soon joins with the first head, and at its union with the latter receives a small tendinous slip (fig. 9, *t.*)

* *Loc. cit.* vol. iv. part I, p. 531.

† *Loc. cit.* vol. viii. p. 135.

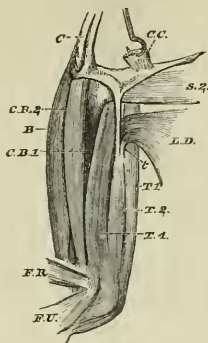
‡ Meckel, *loc. cit.* p. 364.

from the tendon of the latissimus dorsi. Is this head the homologue of the dorso-epitrochlear, which sometimes, as in *Hyrax**, takes origin from the scapular arch, but normally springs from the tendon of the latissimus dorsi?

(3) The third, or external humeral head, arises from the whole outer surface of the humerus below the head of the bone, extending as it does above the insertions of the deltoid and infraspinatus (figs. 1, 2, 8 & 10, *T. 3*).

(4) The last, or internal humeral head (figs. 6, 9 & 10, *T. 4*), similarly arises from the internal surface of the humerus to the head of the bone. At its summit this part of the muscle has contiguous to it, antero-internally, the short part of the coraco-brachialis and the insertion of the subscapularis, while the tendons of the latissimus dorsi and infraspinatus are contiguous to it on its postero-external side (fig. 9).

Fig. 9.



Muscles of inside of right arm, the scapular arch being detached, and the costo-coracoid muscle (*C. C.*) being cut short and reflected.

- B.* Biceps muscle. *C.* Sternal margin of coracoid bone. *C. B. 1.* First, or short, part of coraco-brachialis muscle. *C. B. 2.* Second, or long, part of coraco-brachialis. *C. C.* Costo-coracoid. *F. R.* Flexor carpi radialis. *F. U.* Flexor carpi ulnaris. *L. D.* Latissimus dorsi. *S. 2.* Second part of subscapularis. *T. 1.* First, or external long, head of triceps. *T. 2.* Second, or internal long, head of triceps. *T. 4.* Fourth, or internal humeral, head of triceps. *t.* Tendon from latissimus dorsi to triceps.

All these four portions are united together at above the middle of the arm, and are together inserted into the proximal end of the ulna and into the patella-like sesamoid immediately above it.

Coraco-brachialis. This muscle consists of two parts:—

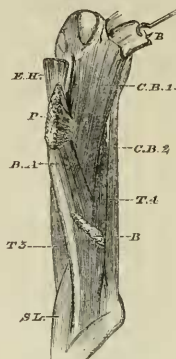
(1.) The first of these, or shorter portion, is a broad muscle, and much resembles the short coraco-brachialis of the *Echidna*†. It arises, by muscular fibres, from the whole outer surface of the coracoid, from the lower spur of the epicoracoid, and from the membrane

* Proc. Zool. Soc. 1866, p. 340, fig. 5, *D. c.*

† Trans. Linn. Soc. vol. xxv. p. 385.

intervening between these, and is inserted into the front of the humerus from the head and internal tuberosity to the middle of its shaft. The limit of its insertion begins above at the insertions of the epicoraco-humeral and pectoralis major, and below is continuous with the origin of the brachialis anticus (figs. 8, 9 & 10, *C. B. 1*). From the extent of its insertion this portion appears to me to answer both to the *coraco-brachialis proprius vel medius* and to the *rotator humeri* or *coraco-brachialis superior vel brevis* of Mr. Wood*.

Fig. 10.



Flexor surface of right upper arm, the biceps and pectoralis major being cut short.

B. Biceps. *B. A.* Brachialis anticus. *C. B. 1 & 2.* Coraco-brachialis. *E. H.* Epicoraco-humeral. *P.* Pectoralis major. *S. L.* Supinator longus. *T. 3 & 4.* Triceps.

(2) The second, longer portion (figs. 6, 8, 9 & 10, *C. B. 2*), which seems to answer to the *coraco-brachialis longus* of Mr. Wood†, arises, by muscular fibres, from the posterior end of the sternal border of the coracoid, and is inserted into the internal condyle of the humerus and into the shaft of the bone for a very slight distance above that condyle. There is a glistening tendon on the side next to the bone of the lower half of this portion of the coraco-brachialis.

The *biceps* (figs. 1, 2, 6, 8, 9, 10 & 12, *B.*) has, as in the *Echidna*‡, but a single head§, which takes origin, by a very broad tendon (with an aponeurotic longitudinal interval), from the anterior (not sternal) margin of the coracoid and adjacent part of the epicoracoid, and passes backwards so as to be immediately superficial to the short part of the coraco-brachialis. It soon fuses with the *brachialis anticus*, and is inserted in common with that muscle (by a very strong tendon, which slightly bifurcates below) into the upper parts of both radius and ulna; but the fibres continuous with the *biceps*

* Journal of Anat. and Phys., Cambridge, 1866, vol. i. pp. 48, 49.

† *Loc. cit.* p. 49.

‡ Trans. Linn. Soc. vol. xxv. p. 385.

§ Unless what I have named *brachialis anticus* be a humeral head of the *biceps*.

appear to go mainly to the ulna. Thus its insertion has much resemblance to that of the same muscle in the *Echidna*.

The *brachialis anticus* (figs. 1, 2, 6, 8 & 10, *B. A.*), which may be, as Meckel appears to think*, a humeral head of the biceps, springs from the front of the shaft of the humerus, immediately below the insertions of the deltoid, epicoraco-humeral, and pectoralis major. It soon fuses with the biceps, and is inserted in common with it into the upper ends of the flexor surfaces of both radius and ulna. The fibres of this muscle, however, appear to be connected mainly, if not exclusively, with the radius.

Supinator longus. This muscle (figs. 1, 6, 10 & 11) is exceedingly large, and, as Meckel observes†, arises by two heads, which do not unite till far down the forearm (fig. 1, *S. L.*). Indeed I find that that head which has the more posterior (lower) origin may be again divisible at and near its origin into two portions, of which the anterior (upper) one is much the smaller; all these parts, however, arise from the external condyle, and have a common insertion into the radial margin of the radius for almost its whole length, and therefore side by side with the pronator teres as far as the latter extends. The head, which has the more posterior (lower) origin, is intimately connected with the radial extensor.

The *extensor carpi radialis*, which appears to answer to both the *longior* and *brevior* of mammals, arises by tendinous fibres from the outer and posterior surface of the external condyle, immediately superficial to the posterior (lower) part of the origin of the supinator longus, with which, for some distance, it is very intimately connected. Passing downwards (fig. 1, *E. R.*) it divides into three parts, which are inserted, each by a tendon, into the proximal ends of the dorsal surfaces of the second, third, and fourth metacarpals.

Extensor communis digitorum. As Meckel observes‡, this muscle has, as it were, "*descendu à la main*" (fig. 11, *E. C.*). It is small, arises from the carpus, and is inserted into the bases of the digits. It is much subdivided, there being more or less distinct fleshy bundles for the several digits.

The *extensor carpi ulnaris* (fig. 1, *E. U.*, and fig. 11, *E. C. U.*) is rather indistinct. It arises indeed by tendinous fibres from the posterior surface of the external condyle; but its insertion is into the adjacent border of another muscle, the flexor carpi ulnaris.

Extensor ossis metacarpi pollicis. This is a rather thick muscle which arises from the posterior surface of rather less than the distal half of the ulna. It is inserted into the metacarpal of the pollex (fig. 11, *E. M. P.*).

Pronator teres (figs. 6 & 12, *P. T.*). The origin of this muscle is by a very strong tendon attached to the summit of the internal condyle. Its fibres spread out, and are inserted into the lower two-thirds of the radial margin of the radius.

The *flexor carpi radialis* (figs. 6, 9, *F. R.*, and fig. 12, *F. C. R.*) arises from the internal condyle immediately below the origin of the

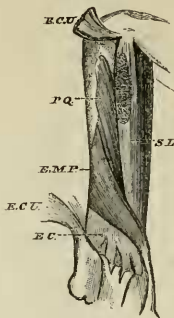
* *Loc. cit.* p. 362.

† *Loc. cit.* p. 367.

‡ *Loc. cit.* p. 391.

pronator teres. It is inserted into the carpal bone, which articulates with the radius, and also by a small tendon running on (figs. 6 & 12) into the radial side of the metacarpal of the pollex.

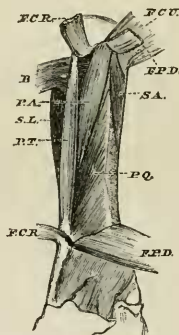
Fig. 11.



Deep muscles of extensor surface of right forearm.

E. C. Extensor communis digitorum. *E. C. U.* Origin of extensor carpi ulnaris and common insertion of extensor and flexor carpi ulnaris. *E. M. P.* Extensor ossis metacarpi pollicis. *S. L.* Supinator longus. *P. Q.* Pronator quadratus.

Fig. 12.



Deep muscles of flexor surface of right forearm, the flexor carpi radialis, flexor carpi ulnaris, and flexor profundus digitorum being cut and reflected.

B. Biceps. *F. C. R.* Flexor carpi radialis. *F. C. U.* Flexor carpi ulnaris. *F. P. D.* Flexor profundus digitorum. *P. A.* Pronator accessorius. *P. Q.* Pronator quadratus. *P. T.* Pronator teres. *S. A.* Supinator accessorius. *S. L.* Supinator longus.

Pronator accessorius (fig. 12, *P. A.*). A muscle I so name provisionally, arises from the anterior surface of the internal condyle, immediately beneath the humeral origin of the flexor profundus digitorum. It is inserted into the radius between the insertion of the pronator teres and that of the pronator quadratus.

Supinator accessorius (fig. 12, *S. A.*). Another muscle, which I also provisionally distinguish by a new name, arises from the internal condyle immediately below, but somewhat superficial to the pronator accessorius. It expands as it descends, and is inserted into about the proximal half of the ulnar margin of the ulna.

The *pronator quadratus* (figs. 11 & 12, *P. Q.*) is broadest below, and becomes very narrow towards its upper end. It arises from the flexor surface of the distal half of the ulna and from the whole radial margin of that bone, and it is inserted into the flexor surface of the radius.

Flexor carpi ulnaris (figs. 1, 6 & 9, *F. U.*, and fig. 12, *F. C. U.*). This forms a large muscular sheet, which, as usual, has the ulnar nerve passing between its double origin—that from the internal condyle and that from the olecranon. It is inserted into both the pisiforme and fifth metacarpal, as Meckel observes*. This muscle receives on its postero-external side the insertion of the extensor carpi ulnaris, the two together forming a layer of muscle which wraps round the ulnar side of the forearm.

The *flexor sublimis digitorum* (fig. 6, *F. S. D.*) is a thin muscle entirely confined to the hand†. It arises from the annular ligament, and is inserted into the second phalanges of the digits, being perforated in each case by a tendon of the flexor profundus digitorum.

Flexor profundus digitorum (figs. 6 & 12, *F. P. D.*). This is a very thick muscle, and has four, more or less distinct heads of origin.

The first head arises from the internal condyle, immediately beneath the origin of the flexor carpi radialis; it very soon unites with the portion arising from the ulna (fig. 6, *F. P. D.* 1).

The second head also springs from the internal condyle, just below the first head; it also joins the portion arising from the ulna (fig. 6, *F. P. D.* 2).

The third portion takes origin from the greater part of the flexor surface of the ulna.

These three portions unite and give rise to a very strong tendon (in which is a palmar ossicle); and into the deep surface of this tendon are inserted muscular fibres, which spring from the carpus and constitute the fourth head of the muscle.

From the distal margin of this tendon proceed the five perforating tendons, one going to each digit.

Lumbricales. I have only observed six lumbrical muscles:—

One going from the ulnar side of the index tendon to the ulnar side of the second digit.

Two from the tendon of the third digit (one on each side), inserted into each side of the third digit.

Two from the tendon of the fourth digit (one on each side), inserted into each side of the fourth digit.

One from the radial side of the fifth digit, inserted into the radial side of the same digit.

Interossei. There are dorsal interossei which arise from the carpus, and are inserted one on each side of the proximal phalange of

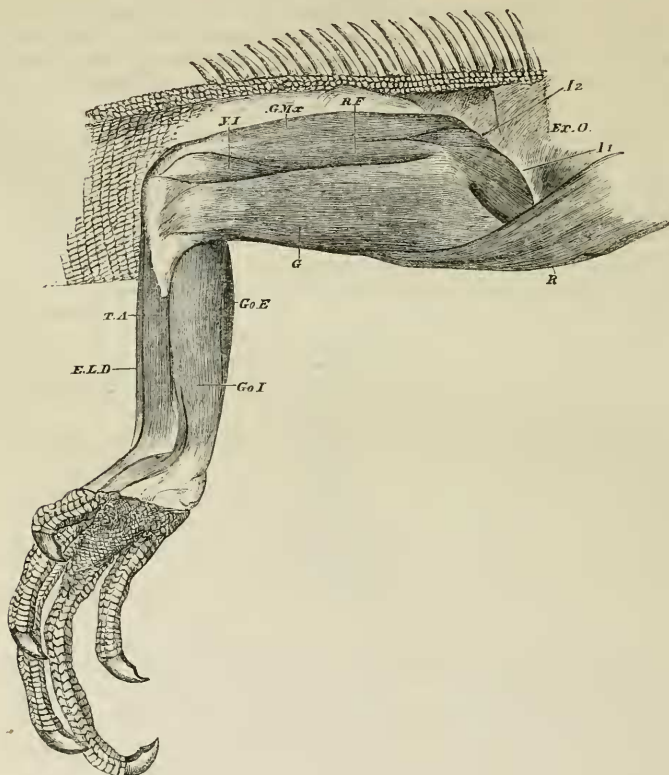
* *Loc. cit.* p. 383.

† Meckel, *loc. cit.* p. 392.

each digit, except the pollex, which has a large bundle of fibres inserted into the dorsal side of the ulnar border of its *metacarpal*!

Palmar interossei also spring from the carpus, and are inserted one on each side of the proximal phalanx of each of the three middle digits. Another rather large fasciculus is inserted into the radial side of the fifth digit, and, no doubt, represents one or more of the spinal muscles of that digit. Finally, a considerable number of muscular fibres are inserted into the proximal phalanx of the pollex and into the palmar side of the ulnar border of its metacarpal. These fibres, no doubt, represent the *flexor brevis* and *opponens pollicis* of higher animals.

Fig. 13.



Right pelvic limb. Superficial muscles of the anterior surface of the thigh and of the flexor surface of the leg.

E. L. D. Extensor longus digitorum. *Ex. O.* External oblique. *G.* Gracilis. *Go. E.* Gastrocnemius externus. *Go. I.* Gastrocnemius internus. *G. M.* Gluteus maximus. *I. 1 & 2.* Iliacus and psoas. *R.* Rectus abdominis. *R. F.* Rectus femoris. *T. A.* Tibialis anticus. *V. I.* Vastus internus.

MUSCLES OF THE PELVIC LIMB.

Psoas and *Iliacus*. I am inclined to regard the complex muscular mass which goes from the inside of the pelvis, passing over its brim to the femur, as the homologue of the *psoas* and *iliacus*. I find present four muscular bundles. The first (figs. 13, 14 & 16, I. 1) arises inside the pubis, from a median raphé separating it from its fellow of the opposite side and also takes origin from the most ventral portion of the pubis, overlapping its brim. Its upper (or posterior) margin is conterminous with the inferior (or anterior) margin of the second part of the muscle, and lies superficially to the third part. Passing over the brim of the pelvis, above the spine of the pubis, it is inserted into the tendinous arch going from the front of the acetabulum to the symphysis ischii, and into the upper half of that part of it which is between the acetabulum and the spine of the pubis. It is intimately connected with the second and third parts of this complex muscle and with the tibial adductor.

The second part of the muscle (figs. 13, 14 & 16, I. 2) lies above (*i. e.* nearer the vertebral column than) the first part. It arises also inside the pelvis, from a median raphé which separates it from its fellow of the opposite side. It is inserted in common with the third portion, and is indeed, in part, only with some difficulty separable from the first portion, with the upper (or posterior) margin of which its lower (or anterior) margin is conterminous.

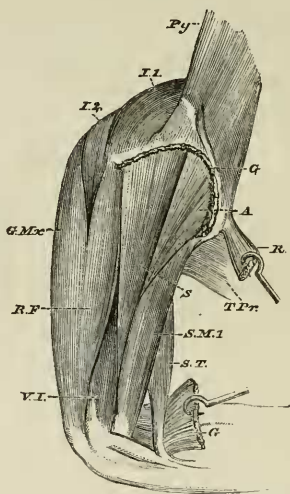
The third portion is a very broad muscular layer, which lies hidden by the first and second portions of the muscle. It arises from the internal surface of the pubis, ischium, and obturator foramen; and the upper (or posterior) part of its origin is easily separable from the more ventral (or anterior) portion. It is inserted into the tibial side of the upper part of the shaft of the femur, internally to the summit of the crureus, just above the insertion of the adductor, and slightly overlapping the tendon of insertion of the femoro-caudal. It is, however, mainly inserted by a strong tendon, which passes across the front of the upper end of the shaft of the femur, beneath the summit of the vastus externus, to the insertion of the gluteus medius, which slightly overlaps it. Thus, the tendinous insertion being on the peroneal side of the bone, while the muscular fibres (inserted with those of the two preceding portions of the *iliacus*) are attached rather to the tibial side, the upper part of the femur comes to be more or less embraced.

The fourth and smallest portion of the complex muscle (fig. 16, I. 4) springs from the surface of that upper (or more posterior) division of the origin of the third part already spoken of (namely that division of the third which arises from the ischium and obturator membrane, and which might be called a fifth portion), and lies nearer the vertebral column than do the other parts. It is inserted in common with the muscular insertion of the third part of the muscle just described; but its fibres are partly continuous with those of the crureus, crossing over the tendon of insertion of the third part of the *psoas* and *iliacus*.

Quadratus lumborum. This muscle (fig. 3, *Q. L.*) is very thick at its origin, but thins out anteriorly. It arises from the crest and anterior part of the internal surface of the ilium, and is inserted into the transverse processes of the lumbar ribs, and also of all, or of almost all, the thoracic ones. Besides the short ribs, it is separated, in the lumbar region, from the superimposed dorsal extensor mass by a strong fascia.

Gracilis. The muscle which appears to me to represent, possibly, the *gracilis* of mammals is a superficial one on the antero-internal surface of the thigh (figs. 13, 14 & 15, *G.*). It arises from the ischiatic symphysis, and from the long tendinous arch which passes from the front of the acetabulum, round behind the pubic spine, back to the symphysis just mentioned. It is inserted into the outer side of the upper part of the tibia, and at its insertion is intimately united with the semitendinosus. At the lower border of the insertion is a strongish tendon (fig. 14, *G.*), which is common to both muscles, muscular fibres from each being inserted into it.

Fig. 14.



Second layer of muscles of anterior surface of right thigh. The gracilis is cut away short above and reflected below. The rectus abdominis is hooked on one side to show the pyramidalis.

A. Adductor magnus. *G.* Gracilis. *G. Mx.* Gluteus maximus. *I. 1 & 2.* Iliacus and psoas. *Py.* Pyramidalis. *R.* Rectus abdominis. *R. F.* Rectus femoris. *S.* Tibial adductor. *S. M.* Semimembranosus. *S. T.* Semitendinosus. *T. Pr.* Transversus perinei. *V. I.* Vastus internus.

The *tibial adductor* is a muscle which arises, beneath the gracilis, from about the upper half of the tendinous arch just mentioned as extending from the front of the acetabulum to the ischiatic sym-

physis (figs. 14, 16, 17 & 18, *S.*). It is slightly connected, at its origin, with the first part of the iliacus, and some fibres spring from the brim of the pelvis just below the tendon of the rectus femoris. Passing downwards between the rectus femoris and the adductor, and passing peroneal of the first part of the semimembranosus, it goes very deeply into the popliteal space (between the two heads of the gastrocnemius), and, uniting with the second part of the semimembranosus, is inserted by a tendon into the peroneal side of the head of the tibia above and behind the insertion of the tendon of the biceps. This muscle is easily separable longitudinally into two parts.

Semimembranosus. This muscle consists of two portions so distinct in insertion that they may well be considered two separate muscles:—

(1) The first portion (figs. 14, 15, 17 & 18, *S. M.* 1) arises from the tuberosity of the ischium, and from the tendinous arch which passes from the posterior end of the ilium to the spine of the pubis. Its origin is nearly in the same vertical line as, though ventral to, the common origin of the biceps and semitendinosus. Thick and fleshy, it is inserted into the back of the leg, embracing the inner head of the gastrocnemius, some fibres passing beneath the internal lateral ligament, while others extend along the posterior margin of the summit of the tibia.

(2) The second portion (figs. 15, 17 & 18, *S. M.* 2) arises in common with the first portion, and is inserted by a tendon (common to it and to the tibial adductor) into the summit of the peroneal surface of the tibia.

The *semitendinosus* (figs. 14, 17 & 18, *S. T.*) springs in common with the biceps from the strong tendinous arch just mentioned as passing from the posterior end of the ilium to the spine of the pubis, behind and a little above the tuberosity of the ischium. It is inserted by a strong tendon, common to it and to the gracilis, into the inside of the upper part of the tibia, at the lower end of the internal lateral ligament. The insertion is mainly superficial to the last-mentioned ligament; but a few tendinous fibres appear to pass inside it.

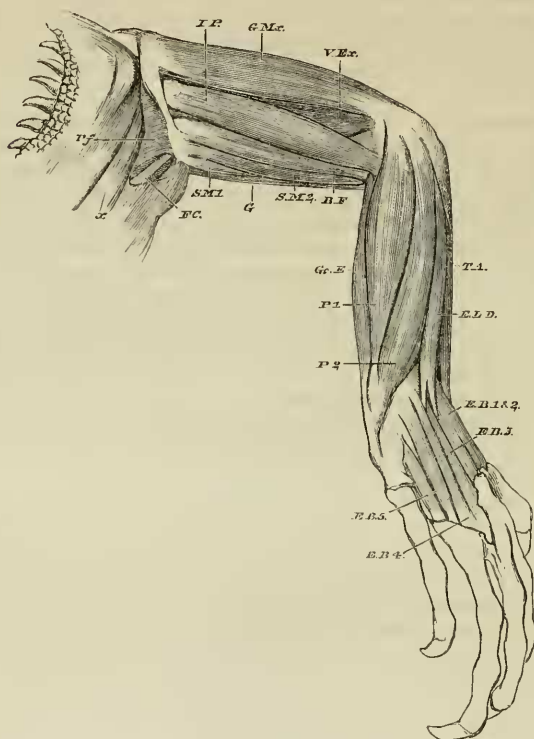
Biceps (figs. 15, 17 & 18, *B. F.*). This arises, in common with the muscle last described, from the strong ligamentous arch passing from the ilium to the spine of the pubis, and arching over the great femoro-caudal tendon. It is inserted by a slender tendon, which goes very deeply into the popliteal space (between the two heads of the gastrocnemius), and, passing between the tibia and fibula, is inserted into quite the anterior aspect of the outer (peroneal) side of the tibia a little below its upper margin and below and in front of the insertion of the tendon common to the second part of the semimembranosus and the tibial adductor.

The *biceps* becomes intimately united with the *gastrocnemius*, as it gives off a strong tendon (fig. 18), which runs down just internal to the outer border of the inner head of that muscle.

Ilio-peroneal (figs. 15, 16, 17 & 18, *I. P.*). A long and strong muscle, which arises from the posterior part of the outer side of the ilium, covered by the posterior portion of the tendinous origin of the

gluteus maximus, and even a little overlapped by the gluteus medius. It is inserted by a strong tendon (which dips in between the peroneus primus and the outer side of the outer head of the gastrocnemius) into the outer side of the fibula, near its summit*.

Fig. 15.



Right pelvic limb. Superficial muscles of the posterior surface of the thigh and of the extensor surface of the leg.

B. F. Biceps femoris. *E. B. 1-5.* Extensor brevis digitorum. *E. L. D.* Extensor longus digitorum. *F. C.* Femoro-caudal. *G.* Gracilis. *G. Mx.* Gluteus maximus. *Go. E.* Gastrocnemius externus. *I. P.* Ilio-peroneal. *P. 1.* Peroneus primus. *P. 2.* Peroneus secundus. *Pf.* Pyriformis. *S. M. 1 & 2.* Semimembranosus. *T. A.* Tibialis anticus. *V. Ex.* Vastus externus. *x.* End of the two median series of lateral caudal cones.

Pectineus? Three portions of muscle seem more or less to represent the *pectineus* :—

(1) A very small part, which arises from the ligamentous arch before mentioned as passing from the front of the acetabulum, round

* Meckel, *loc. cit.* p. 428.

by the spine of the pubis, to the ischiatic symphysis. It is inserted into the summit of the trochanter below, and superficial to, the other two portions (fig. 17, *Pc. 1*).

(2) The second part (fig. 17, *Pc. 2*) arises from the down-turned lip of the pubis, from the acetabulum to the symphysis. It is inserted immediately beneath the preceding portion.

(3) The third part (fig. 17, *Pc. 3*) arises from the symphysis pubis, backwards to the middle of the obturator foramen. At the posterior end of its origin the obturator externus is superficial to it and overlaps it. It is inserted into the summit of the trochanter immediately behind the second part.

The *adductor magnus* (figs. 14 & 17, *A.*) is a rather large muscle, which arises, by strong tendinous fibres, from the anterior part of the strong tendinous arch before mentioned which ends in front at the pubic spine. It is inserted into the inner side of the shaft of the femur (for about the second and third fifths of its vertical extent) between the vastus externus and the vastus internus.

Rectus femoris (figs. 13, 14, 16 & 17, *R. F.*). This muscle arises, by a very strong and rather broad tendon, from the ventral side of the acetabulum. It blends with the other extensors of the leg and with the aponeurosis of insertion of the gluteus maximus.

Vastus internus. A rather small muscle (figs. 14 & 17, *V. I.*) arising from the inside of the shaft of the femur, about as high as the bottom of the uppermost third of the insertion of the adductor; below it blends with the crureus and other extensors of the leg.

Vastus externus (fig. 15, *V. Ex.*). This is exceedingly small, and so intimately connected with the crureus as scarcely to admit of definition. It arises from the lowest two-fifths of the postero-external surface of the shaft of the femur, and is inserted with the rest of the extensor mass.

Crureus (figs. 16 & 17, *C.*). This muscle is so intimately connected with the last as to be separable from it only with great difficulty. It arises from the front of the femur, its origin extending up near to the head of the bone. It is inserted into the patella along with the rest of the extensor muscular mass. At its summit it is, in part, continuous with the fourth portion of the iliacus.

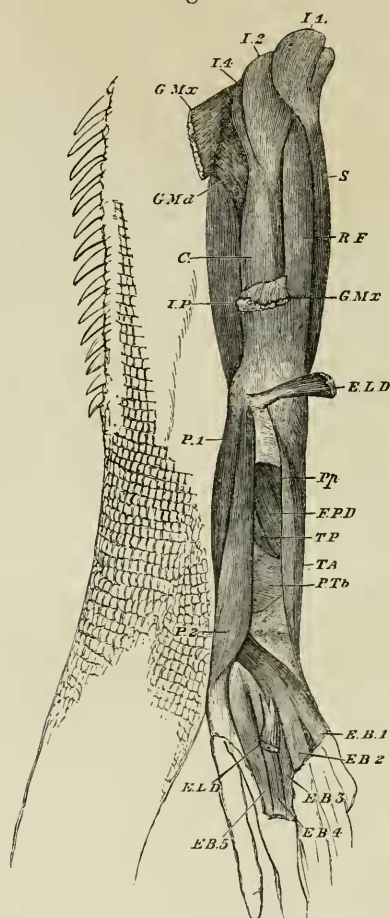
Gluteus maximus (?). A muscular layer, which may perhaps represent the gluteus maximus of mammals*, arises by a very strong tendinous fascia from the outer side and upper margin of the ilium. It covers the antero-external side of the thigh, becomes intimately united with the rectus femoris, and is inserted by aponeurosis into the outer surface of the vastus externus (figs. 13, 14, 15 & 16, *G. Mx.*).

The *gluteus medius* arises from the outer surface of the ilium, between the origins of the gluteus maximus and ilio-peroneal. It is a small muscle, and is inserted into the outer side of the upper part

* I am very doubtful as to whether this muscle and the next are really *glutei*; but the condition of these muscles in *Echidna* inclines me to name them so, provisionally at least (see Trans. Linn. Soc. vol. xxv. 1866, p. 391, and pl. 53. fig. 2. *G. mx.* and *G. md.*).

of the shaft of the femur behind and external to the summit of the origin of the vastus externus. The upper part of its insertion is into the lower portion of the trochanteric fossa (fig. 16, *G. Md.*).

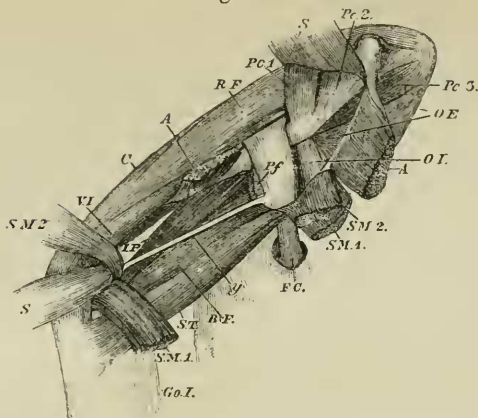
Fig. 16.



Deeper muscles of extensor surface of right pelvic limb. The gluteus maximus and the extensor longus digitorum are each cut short and reflected at both ends.

C. Crureus. *E. B.* 1-5. Extensor brevis digitorum. *E. L. D.* Extensor longus digitorum. *F. P. D.* Flexor longus digitorum. *G. Md.* Gluteus medius. *G. Mx.* Gluteus maximus. *I. 1-4.* Iliacus and psoas. *I. P.* Ilio-peroneal. *P. 1.* Peroneus primus. *P. 2.* Peroneus secundus. *I. P.* Popliteus. *P. T. b.* Peroneo-tibial. *R. F.* Rectus femoris. *S.* Tibial adductor. *T. A.* Tibialis anticus. *T. P.* Tibialis posticus.

Fig. 17.



Deepest muscles of right thigh; ventral aspect. The gracilis is entirely removed. The tibial adductor, the semimembranosus, and the adductor magnus are cut short and reflected.

- A. Adductor magnus. B.F. Biceps femoris. C. Crureus. F.C. Femoro-caudal. Go. 1. Gastrocnemius internus. I.P. Ilio-peroneal. O.E. Obturator externus. O.I. Obturator internus. Pc. 1-3. Pectineus. Pf. Pyriformis. R.F. Rectus femoris. S. Tibial adductor. S.M. Semimembranosus. S.T. Semitendinosus. V.I. Vastus internus. y. Tendon of insertion of femoro-caudal given off from the larger tendon and going to the popliteal space.

*Obturator externus**. This is very fleshy, and arises from the ischium and the outside of the obturator membrane (fig. 17, O. E.). It is inserted into the trochanteric fossa immediately above the summit of the insertions of the gluteus medius and pyriformis.

The *obturator internus*† (fig. 17, O. I.) arises from the posterior part of the deep surface of the ischium. Curving round the outer margin of that bone (between the acetabulum and the tuberosity), it is inserted, by an *exceedingly* strong tendon, into a pit on the outer side of the articular head of the femur.

Pyriformis (figs. 15 & 17, Pf.). This muscle‡ arises from the under surfaces of the first four caudal transverse processes, between the large femoro-caudal muscle on the inside and the conjoined insertions of the two median series of lateral caudal cones on the outside. It is inserted into the strong tendinous arch passing from the ilium to the pubis and enclosing the tendon of the femoro-caudal muscle. Thence taking fresh origin, and accompanied by an anterior fasciculus coming direct from the caudal vertebræ, it is finally

* This appears to answer to the *m. quadratus femoris* of Stannius (p. 134. no. 10).

† The *obturator internus* of Stannius (*loc. cit.* p. 134. no. 5) is a part of my *iliacus*.

‡ It is the *m. subcaudalis* of Stannius (*loc. cit.* p. 133. no. 4).

attached to the base of the back of the trochanter, immediately next to the insertion of the *gluteus medius* on the one hand and of the *femoro-caudal* on the other.

Femoro-caudal (figs. 15 & 17, *F. C.*)*. This exceedingly large muscle arises from the infero-lateral aspect of the caudal vertebrae, where it separates from the vertebral column by its backward intrusion (fig. 5, *F. C.*), the contiguous parts of the ventral, and infero-lateral series of caudal muscular cones. It is inserted, by a very large and strong tendon, into the base of the trochanter on its extensor aspect and above the insertion of the adductor. A little before its insertion this large tendon gives off, nearly at right angles, a long delicate one, which, passing down the thigh into the popliteal space (figs. 17 & 18 *y*), is inserted into the interarticular cartilage between the femur and the tibia, as Stannius has stated†.

The *tibialis anticus* (figs. 13, 16 & 18, *T. A.*) arises from the front of the tibia, the part above the middle of the bone springing mainly from its peroneal aspect, and the part below the middle from its inner aspect. It ends in a single tendon, which is inserted into the tibial side of the distal end of the metatarsal of the hallux.

Extensor longus digitorum. This muscle arises, by a strong tendon (figs. 13, 15 & 16, *E. L. D.*), from the anterior surface of the external condyle of the femur. It continues fleshy down to the metatarsals, when it suddenly narrows and gives off two small tendons, which pass, one on each side of the middle metatarsal bone, near its proximal end. Of these two tendons, the peroneal one curves round tibiad, and is inserted into nearly the middle of the plantar surface of the third metatarsal. The other one is similarly implanted into the second metatarsal.

Extensor brevis digitorum. This muscle may be said to consist of five portions:—

(1) The first part (figs. 15 & 16, *E. B. 1*) is an oblique slip, proceeding forwards and inwards, which arises from the peroneal aspect of the lower end of the fibula, and is inserted into the dorsum of the hallux.

(2) The second part (figs. 15 & 16, *E. B. 2*) is similar in size and direction. It arises from the fibula, below the last, and is similarly inserted into the index digit.

(3) The third portion (figs. 15 & 16, *E. B. 3*) arises, by a strong though small tendon, from a pit in the middle of the anterior surface of the astragalus. Passing between the two tendons of the *extensor longus digitorum*, it is inserted into the dorsum of the third digit.

(4) The fourth part (figs. 15 & 16, *E. B. 4*) arises in common with the preceding, but does not pass between the tendons of the *extensor longus digitorum*. It is inserted into the dorsum of the fourth digit.

(5) The fifth and last part arises, by a strong tendon, from the bottom of the anterior face of the astragalus (figs. 15 & 16, *E. B. 5*). It is also inserted into the dorsum of the fourth digit.

* This is the "*sous-caudien profond*" of Meckel (*loc. cit.* p. 285).

† *Loc. cit.* p. 133. no. 3.

Peroneus primus. This muscle (figs. 15, 16 & 18, *P. 1*) arises, by a strong tendon, from the summit of the outer side of the external condyle of the femur. Passing downwards, it becomes tendinous just below the outer malleolus, and ends in a tendon which is inserted into the peroneal border of the fifth metatarsal bone, a little above its middle. Behind the ankle its tendon expands into a broad, strong, ligamentous fascia, which binds down the flexor muscles, being attached internally to the internal margin of the hinder surface of the astragalus.

Peroneus secundus. A muscle, somewhat larger than the preceding (figs. 15 & 16, *P. 2*), arises from the antero-external surface of the fibula for almost its entire length. It is inserted close above the insertion of the preceding muscle.

Gastrocnemius. Two distinct muscles compose the gastrocnemius:—

(1) The first of these (figs. 13, 17 & 18, *G. I.*) arises from the internal condyle of the femur, where it is closely connected with the insertion of the first part of the semimembranosus, which embraces it. It is also attached to the tibial margin of the tibia, close to the insertion of the semitendinosus. Passing downwards, it soon receives a strong tendon from the biceps, which tendon runs down just internal to its outer border. At the ankle it becomes aponeurotic, and constitutes the most superficial and external part of the plantar fascia.

(2) The second head (figs. 13, 15 & 18, *G. E.*) arises from the femur, immediately above the external condyle. Below it becomes a large muscle, considerably greater than the inner head of the gastrocnemius, which latter passes down superficially to this second portion. Becoming aponeurotic at the ankle, it contributes to form the superficial plantar fascia, especially that part which underlies the three peroneal metatarsals, its fibres, indeed, appearing to form as it were perforated tendons to the third and fourth digits.

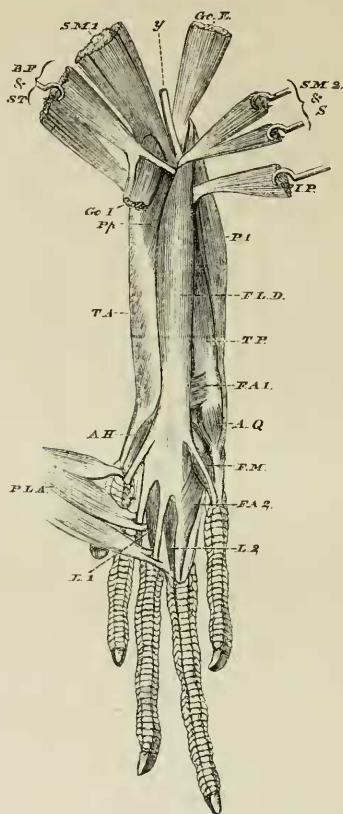
Plantaris. This muscle is at its origin so intimately connected with the outer head of the gastrocnemius that it is with some hesitation that I describe it by a distinct name. About the middle of the leg it separates somewhat from the gastrocnemius externus, and thence widens to the ankle, where it receives a reinforcement of a few muscular fibres from the fifth metatarsal bone, in the distal end of the outer surface of which is implanted a tendon which passes along the peroneal edge of the muscle. In the sole this muscle appears as three fleshy bellies (fig. 18, *P. L. A.*), which form the perforated tendons of the second and third digits, and perhaps of the hallux also.

The *popliteus* arises from the tibial aspect of the head of the fibula, and is inserted into the posterior surface and tibial margin of almost the upper half of the tibia (figs. 16 & 18, *Pp.*).

Flexor longus digitorum (fig. 16, *F. P. D.*, and fig. 18, *F. L. D.*). This rather large muscle arises (1) partly, in common with the last, from immediately above the external condyle of the femur, (2) from the upper third of the posterior surface (or margin) of the fibula, and (3) from almost the upper half of the tibial side of the fibula,

where it is closely connected above with the peroneal side of the popliteus. The second and third portions arise side by side and are closely connected together. Beneath the astragalus this muscle ends in a wide tendon, which divides into five narrow ones, one of these going to the last phalanx of each digit.

Fig. 18.



Flexor surface of right leg; the two heads of the gastrocnemius being cut off short above, and the plantaris reflected below. The semimembranosus, the biceps and semitendinosus, the ilio-peroneal and the tibial adductor are cut and variously reflected.

A. H. Abductor hallucis. *A. Q.* Abductor ossis metatarsi quinti. *B. F.* Biceps femoris. *F. A. 1* & *F. A. 2.* Flexor accessorius. *F. L. D.* Flexor longus digitorum. *F. M.* Flexor minimi digiti. *Go. E.* Gastrocnemius externus. *Go. I.* Gastrocnemius internus. *I. P.* Ilio-peroneal. *L. 1.* & *L. 2.* Lumbricales. *P. 1.* Peroneus primus. *P. L. A.* Plantaris. *Pp.* Popliteus. *S.* Tibial adductor. *S. M. 1* & *S. M. 2.* Semimembranosus. *S. T.* Semitendinosus. *T. A.* Tibialis anticus. *T. P.* Tibialis posticus. *y.* Tendon of insertion of femoro-caudal.

The *tibialis posticus* is very narrow above and very broad below. It arises from the lower half of the posterior surface of the fibula, and its fibres pass downwards and tibial. It ends inferiorly in a broad expanded tendon, which is inserted into the posterior process and whole posterior border of that tarsal bone which fits into the concavity on the under surface of the astragalus (figs. 16 & 18, *T. P.*).

Peroneo-tibial. A remarkable muscle connects together rather more than the lowest two-fifths of the tibia and fibula. Its fibres pass from the posterior surface and tibial border of the last-named bone to the peroneal margin, and to a very little of the anterior margin of the tibia (fig. 16, *P. Tb.*). This muscle is unlike any with which I am acquainted, unless it be the very similar one found in the leg of the Wombat.

Flexor accessorius. Two small muscular bands, which may perhaps be so named, are thus conditioned:—

(1) The first springs from the plantar aspect of the os calcis, and is inserted into the peroneal side of the tendon of the flexor profundus digitorum before its division.

(2) The second part from the tibial aspect of the ridge on the plantar surface of the fifth metatarsal, and is inserted into the tendons of the second, third, and fourth digits (fig. 18, *F. A. 1* and *F. A. 2*).

Lumbricales. I have only detected two muscles which appear thoroughly to answer to mammalian lumbricales.

These arise from the plantar surfaces and tibial sides of the perforating tendon of the third and fourth digits, and go respectively to the tibial sides of the same digits (fig. 18, *L. 1* and *L. 2*).

Three other narrow flat muscular bands go from the deep surfaces of the perforating tendons of the third, fourth, and fifth digits to the plantar surfaces of the proximal phalanges of the same digits.

Abductor hallucis (fig. 18, *A. H.*). This is a flat muscular band, which arises from the plantar surface of the naviculare, very near to the proximal end of the first metatarsal, and is inserted into the proximal phalanx of the hallux.

The *abductor ossis metatarsi quinti* (fig. 18, *A. Q.*) is a similar flat muscular band arising from the distal end of the os calcis, and inserted into the peroneal border of the distal end of a groove on the deep surface of the fifth metatarsal bone. Next the surface of this groove is a strong tendon.

Flexor minimi digiti (fig. 18, *F. M.*). This small muscle arises from the tibial aspect of the ridge on the plantar surface of the fifth metatarsal, and is inserted into the proximal phalanx of the fifth digit.

Interossei. There are dorsal and plantar interossei in the pes very similar to the corresponding muscular fasciculi of the manus; but besides these there is a superficial layer of plantar muscular fibres. This layer takes origin from the tibial side of the cuboid and fifth metatarsal, and is covered superficially by the second part of the flexor accessorius. Spreading out in a fan-like manner, it is inserted into the three middle digits.

14. On the Platyrhine Wombat (*Phascolomys platyrhinus*, Owen). By JAMES MURIE, M.D., F.G.S., Prosector to the Society.

(Plate XXXV.)

In a former paper*, which I had the honour of laying before this Society, I endeavoured to prove, from a study of the skulls and skins, that the genus *Phascolomys* was represented only by three living species, viz. *P. wombat*, *P. platyrhinus*, and *P. latifrons*, and that among fossil species one, *P. magnus*, could alone with propriety be considered distinct from the recent animals.

I then proposed that on a future occasion I should treat of the comparative differences exhibited in the other parts of the osteology of these three mentioned living species.

Several circumstances have caused me to delay putting together in the form of a communication the material then collected as notes. Recently, however, I have obtained four more Wombats for comparison. These afford such evidence of the general correctness of my previously asserted views that I no longer defer completing my unfinished labour.

On my first investigation into the specific differences of the genus *Phascolomys* I was much indebted to Mr. A. D. Bartlett for aid. Again I have to express acknowledgements to him, as through his kind mediation the four specimens of Wombat in question were generously placed at my disposal.

Captain Smart, of the ship 'Murray,' received (in Adelaide, South Australia) five living specimens of the Broad-fronted Wombat (*P. latifrons*), which he endeavoured to bring in safety to this country. During the voyage three of them unfortunately died. The bodies, however, were preserved by him in a strong brine, and one of them reached me in such fair condition as to permit a tolerable minute dissection of it to be made. Of the two others only the skeletons remained perfect. One entire skin and the cranial portions of the skin of its two companions I produce as satisfactory testimony that they all three possess the hairy muzzle, smooth silky fur, and prominent ears characteristic of *P. latifrons*. The skulls (which I now exhibit) also help to remove any existing doubts, if such there should be, as to error in the species. The two remaining living specimens, at present in the Gardens, cannot be mistaken specifically, and they agree in characters with the above-mentioned skin.

Besides the three carcasses spoken of, a still more acceptable boon, because of its rarity, was granted me—namely the examination of the body of a noble-sized Wombat, a thorough representative of *P. platyrhinus*. This animal had been purchased alive by a gentleman in Sydney, New South Wales. During transport to this country it also died. Partially preserved in brine along with the specimens of *P.*

* "On the Identity of the Hairy-nosed Wombat (*Phascolomys lasiorhinus*, Gould) with the Broad-fronted Wombat (*P. latifrons*, Owen), with further Observations on the several Species of the Genus," P. Z. S. 1865, p. 838.

latifrons, it nevertheless has sufficed, through Mr. Bartlett's skill in taxidermy, for a mounted skin to be prepared.

The skull, the skeleton, and the skin of this large Wombat, as I shall hereafter point out, correspond in all essentials to what on the former occasion I was led to regard as *Phascolomys platyrrhinus*.

But, before entering into a consideration of the differentiation presented in the axial and appendicular skeleton of the existing species of Wombat, I deem it necessary to revert to some of my former statements, and to append some fresh information concerning the ostensible relation between the skins and crania of the three species.

Exterior Aspect.

Under the head of colour and general external appearance I shall chiefly confine my remarks to those distinguishing the Platyrrhine from the Common Wombat; for the Hairy-nosed or Broad-fronted species (*P. latifrons*) is not so readily confounded with either of the first-mentioned ones as those two are between themselves.

The accompanying lithograph (Pl. XXXV.) of the large specimen in question from Sydney and another, smaller, browner-coloured animal conveys a tolerable good idea of *P. platyrrhinus*, at least of the more distinguishing features of the species. This large animal is seen to possess an intermediate gradation of colour between what I formerly termed the "pale" and "brown" varieties. Thus, while more nearly approaching the colour of the "big yellow fellow" of the Australian natives (*P. latifrons*, Gould* and *P. setosus*, Gray†) on the sides &c., it still retains upon the back a partial likeness to Dr. Gray's *P. angasi*.

As the illustration shows, the limbs and sides of the body in it are more or less of a yellowish (isabelline) colour, which towards the back assumes a darker and browner shade. The nape of the neck, as formerly described in Mr. Bush's specimen of *P. platyrrhinus*, is darkest, the hairs there being more tipped with black; and, as in it (which I here give as an example of the brown variety), the median line of the back exhibits a continuation of the dark colour backwards to the rump.

The three varieties of *P. platyrrhinus* respectively denominated by me the "pale," the "brown," and the "black" would seem, therefore, in this later-acquired specimen to be further proved to graduate the one into the other—that is to say, if the living animal in the Society's Gardens, which Mr. Gould has named *P. niger*, should, as I suppose, turn out to be only a black variety of *P. platyrrhinus*—a fact yet to be ascertained by an examination of its skeleton.

I find, moreover, that in each of the three species of living Wombat there is a certain tendency to variation in the shade of colour. As regards the Platyrrhine Wombat, I have already mentioned this, and shall only add that there is a tiny young one in the British Museum of a perfect (isabelline) yellow tint. Of the specimens of Common

* Mammals of Australia, 1863, vol. i. text, and plates 57, 58.

† Annals and Magazine of Nat. Hist. 1863, vol. xi. p. 457.

Wombat some are darker than others; and this fact is seen even in two very young animals of this species in the same collection. Comparison of the Hairy-nosed Wombats shows also that some of them assume a browner hue than others.

There is one point which the recent acquisition of the specimen of *P. platyrrhinus* confirms, namely, the entire absence of the grizzly greyish tint, which is so very strongly marked and constant in the common species (*P. wombat*).

The peculiar silky structure of the fur of *P. latifrons* was adverted to in my former paper. *P. platyrrhinus* possesses the very reverse, the fur being coarse (almost bristly) to the touch. *P. wombat* has it of an intermediate fineness. So perceptible is this difference that the three species might almost be identified by touch alone.

Osteology.—The Skull.

The object of the present paper is not so much a perfect and detailed description of the entire osteology of *Phascolomys platyrrhinus* as of differentiation and specific distinction between it and other forms of the genus; I have therefore limited my remarks chiefly to those points elucidating variety or otherwise in its osseous conformation. Besides, the skeleton of the Common Wombat is well known, and has been sufficiently figured by Prof. Owen* and others; so that *P. platyrrhinus*, possessing only minor distinctions, needs not lengthened descriptive repetition.

Phascolomys latifrons, on the other hand, shears off from the common form of Wombat, and reverts to the true marsupial type in several particulars. Its skull has been well illustrated in vol. iii. of our 'Transactions;' and the graphic seizure of its salient points precludes the necessity of reiteration. As Prof. Owen has there clearly shown, the skull of *P. latifrons* presents such marked characters as to entitle it to specific distinction solely thereupon.

But between the skulls of the remaining two (*P. platyrrhinus* and *P. wombat*) no such clear line of demarcation exists. I find, after a careful reexamination of a more extensive series of crania, that these last-mentioned forms have very close resemblances to each other—or rather, I should say, that they glide together so insensibly by intermediate forms that the osteologist might find difficulty in assigning some specimens to their proper species, were it not that size lends aid to the determination.

Nevertheless, although freely admitting the tendency to gradation observable in a series of skulls of *P. platyrrhinus* and *P. wombat* (those examined by me were some twenty in all), I have still the satisfaction of finding that such distinguishing characters as I pointed out in the published paper referred to, in the main hold good. But be it observed that while in no ways asserting that the skull of a young specimen of *P. platyrrhinus* can at once and with certainty be distinguished from that of an adult but loosely connected cranium of *P. wombat*, I have yet reason to believe that with specimens of

* Trans. Zool. Soc. vol. ii. pl. 68.

an equal age (*e. g.* adult to adult or young to young) the same difficulty would not be encountered.

In my former paper (P. Z. S. 1865, p. 847) I have set down the specialities of *P. platyrrhinus*, as compared with *P. wombat*, to be these four:—(a) The greater size of the cranium. (b) The greater relative breadth of the nasal bones. (c) The moderately deep tympanic excavation. (d) The more triangular form of the posterior palatine foramina.

In elucidation of the proportional magnitude of the crania of the three species of Wombat I append the subjoined table. The first column represents the lately acquired skull of *P. platyrrhinus* (the larger animal figured in Pl. XXXV.), and the two next columns those of the specimens of *P. latifrons*. They are each taken in inches and lines, and correspond to the table of admeasurements of skulls given in my former paper. The remaining columns respectively show in twelfths of an inch the average of seven specimens of *P. platyrrhinus*, six of *P. wombat*, and four of *P. latifrons*.

Measurements of Skulls and Series of Average Proportions.

	Mr. Bartlett's specimen of <i>P. platyrrhinus</i> .		Mr. Bartlett's specimen of <i>P. latifrons</i> , No. 1.		Mr. Bartlett's specimen of <i>P. latifrons</i> , No. 2.		Average measurements of seven specimens of <i>P. platyrrhinus</i> .	Average measurements of six specimens of <i>P. wombat</i> .	Average measurements of four specimens of <i>P. latifrons</i> .
	in.	lin.	in.	lin.	in.	lin.	lines.	lines.	lines.
Total length of cranium	8	9	6	8	6	3	92	75	77
Greatest width, which is at the posterior part of the zygomatic arch	5	9	4	9	4	3½	67	57	56
Width of skull behind orbits, where con- tracted by temporal fossæ	2	2	1	7	1	6	24	18	18
Width at anterior part of zygomatic arch ...	4	7	3	10	3	6½	53	43	45
Length from occipital crest to temporal fossa	2	3	1	11	1	11	26	21	23
Length of nasal bones	3	3	2	3	2	1	34	28	25
Width of same behind	2	3	2	4½	2	2	26	19	28
Width of same near apex	0	9	1	1	1	0	10	7	13
Length of frontal bones	3	5	2	4½	2	2	34	27	28
Width of same between orbits	2	6	2	9	2	5	29	23	32
Width of each intermaxillary bone as seen from above	0	11	0	2	0	2½	8	7	2
Length of palate	4	9	3	7½	3	5	52	38	43
Width between anterior molars	0	6	0	5	0	4½	4	4	5
Width between posterior molars	1	0	0	10½	0	9½	10	8	10
Width of both superior incisor teeth	0	8½	0	10	0	8½	9	7	9
Depth of same taken singly	0	6	0	3	0	3	5	3	3
Distance between incisor teeth (upper jaw) and molars	2	0	1	7½	1	6½	17	14	19
Total extent of row of molar teeth	2	3	1	10	1	10	26	23	22
Length of lower jaw	6	9	5	3½	4	9	71	53	57
Greatest breadth of same	5	11	4	5½	4	1½	68	55	51
Height in a vertical line dropped from coronoid process	3	7	3	1½	3	1	36	35	36
Width of lower incisors	0	7½	0	6	0	5½	7	7	6
Depth of the same	0	4½	0	3	0	3	4	3	3

First.—As to the greater relative size of the cranium, the above average measurements bring out that the proportion of breadth (at the posterior part of the zygomatic arch) to the length in

<i>P. platyrrhinus</i>	is as	73 to 100
<i>P. wombat</i>	„	76 to 100
<i>P. latifrons</i>	„	73 to 100

Again the proportion of breadth to length at the anterior part of the zygomatic arch in

<i>P. platyrrhinus</i>	is as	57 to 100
<i>P. wombat</i>	„	57 to 100
<i>P. latifrons</i>	„	58 to 100

The mandible bears correspondence to the first of these proportions; in it the breadth is to the length in

<i>P. platyrrhinus</i>	as	95 to 100
<i>P. wombat</i>	„	104 to 100
<i>P. latifrons</i>	„	89 to 100

From these results, then, it would appear that, besides absolute greater length, *P. platyrrhinus* and *P. latifrons* agree in having relatively a narrower skull than *P. wombat* at the hinder part of the zygomatic arch, while *P. platyrrhinus* and *P. wombat* resemble each other, again, in the comparative narrowing at the front part of the zygoma.

Second.—The shape and greater relative breadth of the nasal bones is a point which, if constant, would serve admirably as a differentiating characteristic. For instance, in six examples of *P. latifrons*, of various ages, the skulls of which I placed side by side, there was only one which exhibited a very slight perceptible difference in the nasals. It, as well as all the others, was of an extremely regular equilateral triangular form. The exceptional specimen (No. 1843, Osteological Series, College of Surgeons*) had a slight break in the basal line of the forehead, wherein was wedged a narrow sharp-pointed process of the frontal. In other respects the straightness of the contour basal line was not altered.

A similar inspection of crania of *P. platyrrhinus* does not, however, afford the same striking uniformity. At first sight there is seemingly a great irregularity in the form of the nasals; but these deviations resolve themselves into three kinds: one of these approaches the equilateral triangular figure found in *P. latifrons*; another merges into what is more commonly obtained in *P. wombat* (namely a kind of spear-headed pattern); and the third is of an inconstant and intermediate grade between these two extremes.

The proportional breadth of the two nasal bones at their hinder ends is to their length in

<i>P. platyrrhinus</i>	as	76 to 100
<i>P. wombat</i>	„	68 to 100
<i>P. latifrons</i>	„	112 to 100

* Owen's type specimen, for a representation of which, of the natural size, see 'Trans. Zool. Soc.' vol. iii. pl. 37. f. 4.

Towards the anterior ends of the nasals the breadth in proportion to length is in

<i>P. platyrrhinus</i>	as 29 to 100
<i>P. wombat</i>	„ 25 to 100
<i>P. latifrons</i>	„ 52 to 100

The relation of breadth to length in *P. platyrrhinus* is manifested most distinctly in the first and third forms. In these the fronto-maxillary suture approaches nearer the orbits, and the width of the nasals continues forward generally beyond their middles; in the first the nasals begin to narrow only at the anterior third. In the pattern which most nearly approaches that of *P. wombat* (*i. e.* spear-headed), the fronto-nasal articulation, from its angular setting, gives the nasals a certain narrowness; the naso-premaxillary sutures also early (at the posterior one-third) run towards each other, and continue narrowing forwards, so that the anterior two-thirds, compared with the posterior one-third, is very narrow.

It is this very far backward narrowing, therefore, wherein consists any real difference between *P. wombat* and *P. platyrrhinus*; so that the breadth of the anterior half of the nasals, compared with the corresponding adjoining premaxillaries, is in a series relatively greater in *P. platyrrhinus* than in *P. wombat*. The reverse or greatest relative breadth at the top of the premaxillaries is in favour of *P. wombat*. But this rule has occasional exceptions, which, however, do not militate against the general correctness of the proposition.

Third.—As to the moderately deep tympanic excavation in *P. platyrrhinus*, this obtained, with modifications, in six of the seven skulls of this species examined. The converse was observed in *P. wombat*, where one out of nine alone possessed a tendency to deep and broad excavation of the supratympanic region.

Fourth.—The more triangular form of the posterior palatine foramina. This character, as so expressed, requires modification, inasmuch as in the Platyrrhine Wombat, although it is generally large and has an elongated and somewhat triangular form, yet this is subject to variation. In the Common Wombat it is even more inconsistent, more often, however, round and small.

The Vertebral Column.

The regional distribution of the vertebral column in the genus *Phascolomys* is as in Marsupials generally; but the total number of vertebral elements in the dorsal, lumbar, and caudal regions varies so far as *P. latifrons* is concerned. *P. platyrrhinus* and *P. wombat* agree, excepting in the former of these two possessing occasionally an additional caudal ossicle. *P. latifrons*, on the contrary, seems always to have two less dorsal vertebræ, which come to be reckoned as additional lumbar ones, while the caudal vertebra may be said to be more than either of the other mentioned species.

The vertebral formula, according to my investigations, is represented as follows:—

<i>P. platyrrhinus</i>	Cv. 7, D. 15, L. 4, S. 4, Cd. 12,	=42.
<i>P. wombat</i>	.. Cv. 7, D. 15, L. 4, S. 4, Cd. 10 to 11,	=40 or 41.
<i>P. latifrons</i>	.. Cv. 7, D. 13, L. 6, S. 4, Cd. 15 to 16,	=45 or 46.

Cervical Vertebrae.—It has been remarked by Prof. Owen* that in the Koala and Wombat the body of the atlas remains permanently cartilaginous. This observation appears not to be exceptional in the case of *Phascolomys platyrrhinus* and *P. latifrons*, where the bony ring is incomplete in both. In the specimens examined by me of *P. platyrrhinus* the bony separation was as much as 0·4 of an inch, and in *P. latifrons*, as in *P. wombat*, about 0·3".

The first cervical vertebra in *P. platyrrhinus*, besides slightly larger dimensions, has a sensibly higher arched lamina than either *P. wombat* or *P. latifrons*, and there is the rudiment of a neural spine. The breadth from before backwards of the neural arch is usually greatest in *P. latifrons*; but this is not constant. The transverse processes seem also relatively longer and broader in *P. platyrrhinus*, although this may only appear to be so from the generally increased size of the vertebrae. They, however, are flatter in *P. latifrons*, in this respect approaching to the shape found in the Koala.

The greatest diameter to the tips of the transverse processes in the specimens compared respectively measured 2"·6 in *P. platyrrhinus* and 2"·2 in *P. wombat* and *P. latifrons*.

The antero-posterior diameter of the body of the axis in *P. latifrons* is comparatively greater than in either *P. platyrrhinus* or *P. wombat*.

In *P. platyrrhinus*, however, the perforated transverse processes extend considerably beyond the body, whereas they are short in *P. wombat* and *P. latifrons*, where they barely reach outside the anterior articulating surfaces.

The peculiar feature of the neural spine of the axis in *P. latifrons* is its possessing only in a slight degree the anterior projection, which is strongly marked in *P. platyrrhinus*, and even relatively more so in *P. wombat*. The superior border from this to the summit of the spine is also very perpendicularly inclined in its arch in *P. latifrons*; and both behind and before the neural spine and laminae there are not such deep concavities as in the two other species. In this manner the neural spine has a sharper and half-crescentic form, distinguishing it from the other species.

The two specimens of *P. platyrrhinus* examined varied, inasmuch as one had a spine of the shape attributed to *P. latifrons*; the other reverted to what is found in *P. wombat*—namely, where the spine is derived from broad laminae whose anterior and posterior edges are deeply concave.

In the succeeding cervical vertebrae *P. wombat* has the neural spine of the fourth slightly longer than those of the third, fifth, sixth, and seventh, which last are all about equal in length. In *P. platyrrhinus* the third cervical has only the rudiment of a spine, which is bifid and corresponds to a tubercle on the posterior arched concavity of the neural spine of the axis. The four cervical vertebrae posterior to the third have their spines nearly alike in length; the seventh, however, is perceptibly the longest. In *P. latifrons* the seventh neural spine is by far the longest (with the exception of that of the axis);

* *Op. cit.* p. 394.

the four neural spines in advance of it are subequal in length, besides being shorter.

Dorsal vertebræ.—Among the Marsupialia the dorsal vertebræ are thirteen in number, except in *Phascolomys wombat*, which has fifteen. *P. platyrhinus*, then, agrees with the latter in this respect; but *P. latifrons*, on the other hand, disagrees with its two allied specific forms, and reverts to the usual marsupial character.

In the three species of *Phascolomys* the number of dorsal and lumbar vertebræ taken collectively are nineteen. Of these, in *P. platyrhinus* and *P. wombat*, as the preceding formula shows, there are fifteen dorsal and four lumbar; but in *P. latifrons* there are only thirteen rib-bearing dorsal, and consequently six lumbar vertebræ.

The bodies of the dorsal vertebræ in *P. platyrhinus* and *P. wombat* resemble each other, excepting in size. The under surfaces of the centra are slightly laterally compressed, which gives the appearance of increased vertical depth, which they otherwise do not possess; this is most marked in the large adult male of *P. platyrhinus*. The bodies increase in antero-posterior thickness from the first to the last.

In the size of the bodies of the dorsal vertebræ *P. latifrons* agrees most with *P. wombat*. One specimen of *P. latifrons* presented a peculiar flattening of the under surface of the bodies.

In the largest *P. platyrhinus* the laminar arches are flatter and altogether broader. A better comparison is made between *P. wombat* and *P. latifrons*, on account of the equality of size; this brings out the fact that in the latter the neural laminæ, as seen from above, are relatively narrower than in the former species.

In one specimen of *P. latifrons* the neural spine of the first dorsal possessed a bifid tip, in all the other specimens of this and the two species compared it was single. In *P. platyrhinus* the same spine at its upper half has considerable antero-posterior flattening. This terminal flattening is just observable in *P. wombat*; but in *P. latifrons*, excepting the divergence of the bifid extremity, the spine is laterally compressed.

The remainder of the neural spines are relatively longer and more laterally compressed in the species *P. latifrons*; their antero-posterior diameter is also greatest.

In the powerful body of *P. platyrhinus* the dorsal spinous processes have each a bulbous extremity, and the sides of each spine are marked by grooves for the attachment of muscles.

All three species have the first dorsal spine the longest, those behind diminishing gradually until they reach the shorter and broader neurapophyses of the lumbar region.

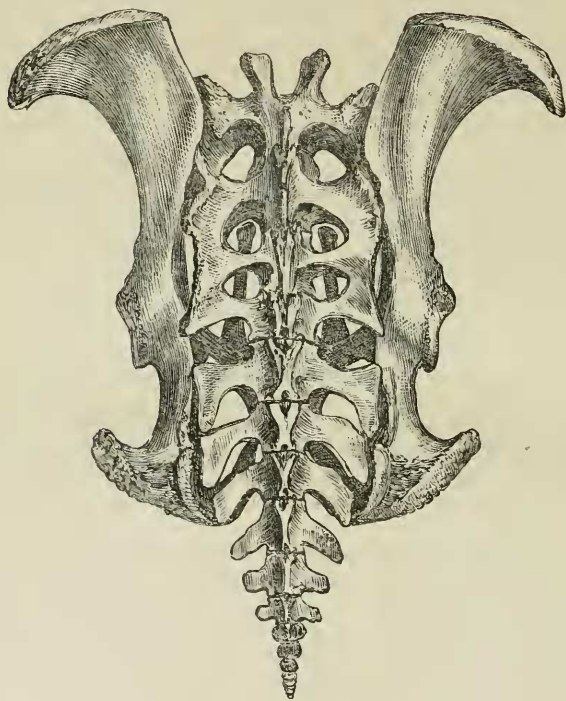
In the Common Wombat, as Owen has mentioned*, the metapophysis rises suddenly from the outside of the prozygapophysis of the twelfth dorsal, increases in length to the second lumbar, diminishes by degrees to the second sacral, and is rudimental in the following sacral and caudal vertebræ. The same remarks apply to the Platyrrhine Wombat.

* Osteological Catalogue Coll. Surg. vol. i. p. 330 (1853).

In *P. latifrons*, from the altered distribution of the dorsal and lumbar vertebræ, the metapophyses, commencing sometimes at the eleventh and sometimes at the twelfth dorsal vertebra, continue to increase in size to the fourth lumbar, after which they diminish as in the other species.

The anapophyses, which in *P. platyrrhinus* and *P. wombat* are first observable on the eleventh dorsal, in *P. latifrons* make their appearance very rudimentally on the eighth and ninth dorsal. The diminution of these processes in the lumbar and disappearance in the last of the series are alike in the three species.

Fig. 1.

Bones of the pelvis of *P. platyrrhinus*. One-third nat. size.

Lumbar Vertebrae.—From these being only four in number, as well as from their having a wider stretch of transverse processes, *P. platyrrhinus* and *P. wombat* possess short, broad loins; whereas in *P. latifrons* the lumbar region is narrow, elongated, and conical in shape. The average proportional length of the lumbar region between the three species is respectively $4\frac{1}{2}$, $4\frac{1}{4}$ and $6\frac{1}{2}$ inches,—the dorsal region contrariwise measuring $12\frac{1}{2}$, 10 and $9\frac{1}{4}$ inches in the

Fig. 2.

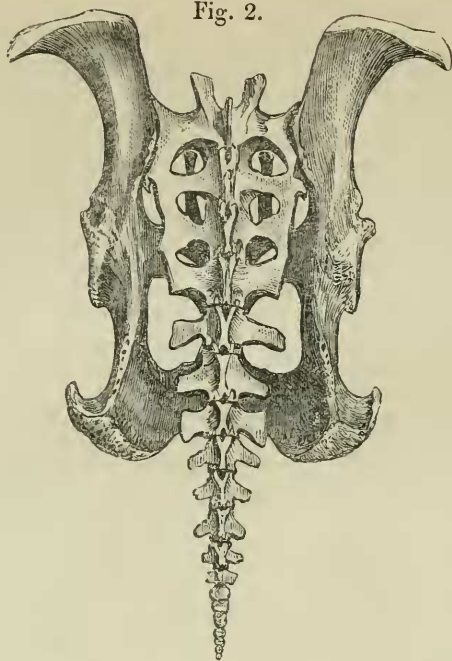
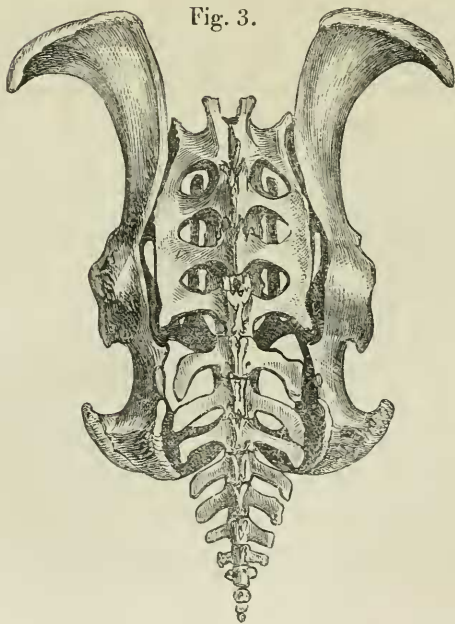


Fig. 3.



Bones of pelvis. Fig. 2. *P. latifrons*. Fig. 3. *P. wombat*. One-third nat. size.

same specimens. In *P. latifrons* the same flattening underneath of the bodies of the lumbar vertebræ occurs as in the dorsal region, but the bodies altogether seem stronger than in similar-sized Wombats.

In *P. platyrhinus* the transverse processes of the lumbar vertebræ are immensely long. The first and last are shorter than the two middle ones. The hindmost three are wider than the sacrum. Compared with those of *P. latifrons* they are narrower antero-posteriorly and somewhat rounder. The size being less in *P. wombat*, they otherwise correspond to what has been said of *P. platyrhinus*.

All the examples of *P. latifrons*, none of *P. platyrhinus*, and only one of *P. wombat* exhibited short suturally connected pleurapophyses resting upon the diapophyses of the first lumbar vertebræ.

If other proof were wanting of the termination of the dorsal and commencement of the lumbar vertebræ in *P. latifrons*, the presence of these pleurapophyses in *P. wombat*, where fifteen ribs exist, would satisfy objections which might be raised, that in *P. latifrons* their more regular occurrence indicated a greater number than thirteen ribs as the normal condition.

Sacrum.—In defining the number of sacral vertebræ present in specimens of the Common Wombat, Prof. Owen remarks*, "If we regard those vertebræ only as sacral which join the *ossa innominata*, then there are but three"—more often, it will be found, only two. If, on the other hand, anchylosis is the test, then the sacral vertebræ may vary from 3 to 4-5, or even as many as 7, in number in different specimens. I am inclined, however, to agree with a further statement of the same anatomist, that four are the normal number of bones (Cat. Coll. Surg. p. 330).

Besides the fact that the four vertebræ succeeding the lumbar ones have transverse processes directed almost straight outwards, or the posterior two of them even somewhat forwards, in contradistinction to the vertebræ behind, which have transverse processes inclined at an angle backwards, there is the still more cogent reason, that the sacral plexus passes through the three foramina, bounded by the usually coalesced four sacral elements.

This division between true sacral and caudal vertebræ is remarkably well seen in specimens of *P. latifrons*, where the transverse processes are shorter and less liable to anchylosis than in either of the other species.

The sacral vertebræ of *P. platyrhinus* are chiefly distinguishable from those of *P. wombat* by the greater width of the transverse processes and by their unusual flatness both on the pelvic and dorsal surfaces. The extent of the auricular surface abutting against the ilia is relatively greater; and, as compared with most specimens of *P. wombat*, the base of the sacrum and anterior edge of the first transverse process reach somewhat further forwards on the ilia. These conditions appear to give greater lateral and longitudinal capacity to the cavity of the pelvis; indeed it is the width and flattening of the dorsal surface of the sacral region of the pelvis continued backwards towards the tail which produces the characteristic hinder

* Trans. Zool. Soc. vol. ii. p. 396.

truncation of the body or shield-like flattening so very remarkable in the living Platyrrhine Wombat.

P. latifrons differs from the other species in having the transverse processes of the sacral vertebræ shortening from the first to the fourth; in other words, the sacrum narrows behind, whereas in *P. platyrrhinus* and *P. wombat* it is as broad, if not broader posteriorly than anteriorly.

Caudal Vertebræ.—In all the species the first six have transverse processes, the seventh vertebra in each presenting a rudimental one. The processes generally of the remaining caudal vertebræ are very obscure, and the last two or three are little better than tiny ossicles.

In *P. platyrrhinus* the great length and breadth of the backwardly inflected transverse processes of the first three or four caudal vertebræ is somewhat remarkable. These almost reach the tuber ischii, so that the sacral and these anterior caudal vertebræ taken together present a long, broad, and flat shield, which in the live animal (*P. niger* of Gould) in the Gardens is very conspicuous.

The Common Wombat, though very much resembling *P. platyrrhinus* in its caudal elements, seems to have the transverse processes relatively shorter, and consequently to present a greater interspace between their tips and the inner border of the ischium.

P. latifrons is readily distinguished by the very much shorter and pointed nature of the caudal transverse processes; but these are, moreover, comparatively broader antero-posteriorly at their roots than in *P. wombat* and *P. platyrrhinus*.

From this shortening of the outstanding transverse processes, and a more or less greater length in the vertebræ themselves, the caudal region in *P. latifrons* entirely wants the short truncated aspect present in the other two species.

In all the animals when alive the tail is very short, but it is more perceptible in the Hairy-nosed Wombat than in Common and Platyrrhine species.

Sternum and Ribs.

Sternum.—I have found the bones of the sternum of the specimens of the Platyrrhine and Hairy-nosed species, except in one instance, four in number, as is the case in the Common Wombat. In the exceptional example (a portion of a disarticulated skeleton of *P. platyrrhinus* in the College of Surgeons, at present labelled *P. wombat*) there are five bony pieces composing the sternum. This peculiarity in the number of sternal elements is a reversion to what obtains in the *Petaurus taguanoides*.

The sternal bones of *P. platyrrhinus* are altogether much the largest of the three, but those of *P. latifrons* are relatively the stoutest. The hindmost bone, that to which the xiphoid cartilage is attached, is broadened posteriorly in *P. platyrrhinus*, the fifth rib-cartilages abutting against the lateral protruding portions. In *P. latifrons* this bone is obtusely pointed, and in *P. wombat* more abruptly truncated posteriorly.

Ribs.—The Common Wombat has been regarded as very anomalous. Proc. Zool. Soc.—1867, No. LII.

lous among the Marsupials, by reason of its having fifteen ribs, in contradistinction to the other genera of its family, which have thirteen, excepting the Petaurists, where they are twelve in number. The *Phascolomys latifrons*, however, reduces this anomalous character to specific variety, for in it we have a return to the usual Marsupial number of thirteen. This diminution in the number of ribs may of itself be regarded as a marked character, fully justifying and carrying out Prof. Owen's proof, from the skull, of the specific distinctness of the animal.

This circumstance, however, is unfortunate for the Professor's reasoning upon the adaptive design of Wombats having fifteen pairs, as opposed to other genera of the Marsupialia. He remarks*, "The pressure to which the trunk of the Wombat must occasionally be subjected, in its subterranean burrowings, is probably the condition of the development of the additional pairs of ribs in that species." But in *P. latifrons* we have a doubtless burrowing Wombat wherein no more than the usual development of ribs in the Marsupials is found; for Mr. G. F. Angas's observations† lead to the belief that, so far as scratching and burrowing are concerned, the Hairy-nosed Wombat is a thorough adept in the art.

The ribs in the Platyrrhine Wombat bear a proportion to its much more strongly built body; and anteriorly the grooves for the attachment of the intercostal muscles are well marked. Both the Common and Hairy-nosed species have rounder as well as weaker costæ. In all the species the first rib is the flattest and shortest one.

Bones of the Fore Limb.

Scapula.—There is a distinct and well-marked difference in the form of this bone in the three species of Wombat, and such as would not occur by mere growth from a younger towards an older condition—that is, supposing that *P. wombat* were but an immature stage of the larger-sized *P. platyrrhinus*.

For example, the proportional breadth to length is in *P. platyrrhinus* as 72 to 100, in *P. wombat* 53 to 100, and in *P. latifrons* 56 to 100, the preponderance of breadth to length, then, being greatly in favour of the Platyrrhine species.

In *P. platyrrhinus* the scapula approaches to a square form, and is not oblong as in *P. wombat*, or irregularly oblong as in *P. latifrons*. The total length of the bone is more nearly alike in the three species; but the relative breadth in the first named is almost one-third greater. The entire bone in *P. platyrrhinus* is immensely strong and massive, and the free margin of the spine is unusually broad for attachment of the muscles.

In *P. latifrons* this bone does not conform to the remarkably regular oblong quadrate figure which Prof. Owen has pointed out to be characteristic of *P. wombat*‡, where the superior and inferior costæ run nearly parallel the one to the other.

* Trans. Zool. Soc. vol. ii. p. 396.

† P. Z. S. 1861, p. 270.

‡ Trans. Zool. Soc. vol. ii. p. 399.

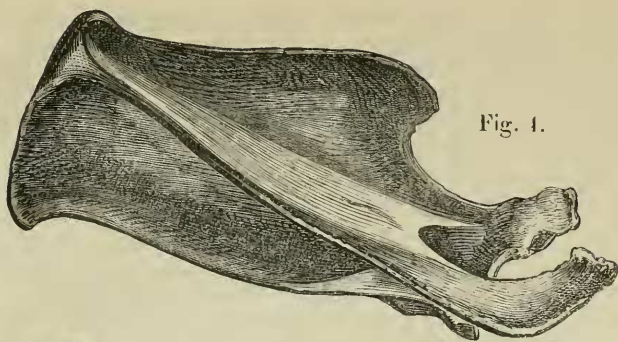


Fig. 4.

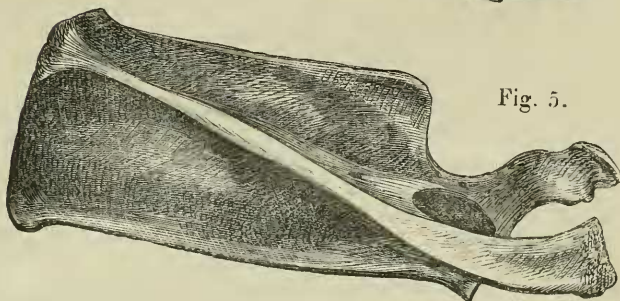


Fig. 5.

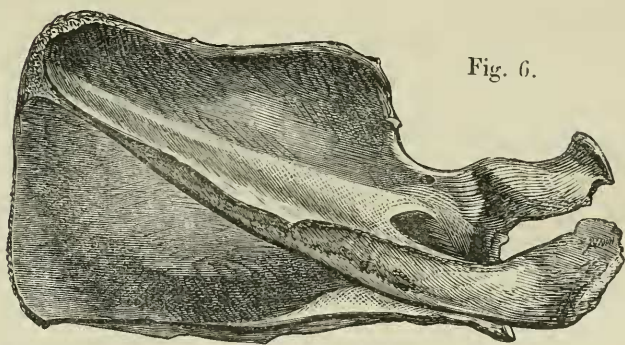


Fig. 6.

Scapula of the three species of Wombat. Two-thirds nat. size.

Fig. 4. *P. latifrons*.

Fig. 5. *P. wombat*.

Fig. 6. *P. platyrhinus*.

The scapular spine is likewise more arched and higher in the Broad fronted Wombat than in the common species, the curvature commencing closer to the base, rising almost two-tenths higher opposite to the root of the neck, and falling again as it forms the acromion, which last is much more elongated, and ends at the clavicle in a

sharper-pointed inwardly curved process. The free border of the spine is not thick posteriorly; but it becomes equal to that of *P. platyrrhinus* and almost broader than that of *P. wombat* at the posterior half of the acromion process.

The coracoid process is bent downwards and inwards, as usual in *P. wombat*; but the groove where the biceps tendon is lodged is in *P. latifrons* shallower. Towards the neck it rises with a convexity, and with a roughened elongated pit for the insertion of the tendon of the biceps.

In the Common Wombat the supra- and infraspinous fossæ are very flat; whereas in *P. latifrons* and, to a lesser extent, in *P. platyrrhinus* they are concave, more especially the infraspinous fossa. The subscapular surface of the bone in Wombat has shallow ridges and furrows, but in the other species these are much more marked.

Clavicle.—In the Platyrrhine and Common Wombats this bone equally has a double curvature, being by far the stronger and more grooved in the former animal.

In the Hairy-nosed Wombat the clavicles are somewhat straighter than in the others. Of about equal length to those of the Common species, they, in consequence of their straightness and also more inward projection of the acromion processes, give an apparently greater breadth of chest to the Hairy-nosed species.

Humerus.—The humerus of *P. platyrrhinus* is $4\frac{6}{10}$ inches long, of *P. latifrons* $4\frac{2}{10}$, and in the specimen of *P. wombat* examined $4\frac{5}{10}$ inches.

Excepting in the inequality of size, this bone in the first two species is hardly to be distinguished; but in *P. wombat*, although bearing a close resemblance to them in general outline, it has nevertheless pointed differences. Its breadth, both in shaft and extremities, is relatively one-third less; the deltoid ridge is not so prominent; and, moreover, in *P. platyrrhinus* and *P. latifrons* this has its outer margin rolled backwards so as to give a greater depth behind to that portion of the shaft. The posterior part of the articulating surface of the head of the humerus in the two latter curves considerably backwards, which is not the case in *P. wombat*, neither has this last such rough processes for the attachment of muscles. In neither of the specimens under consideration was the interspace of the condyles perforated*, as is said occasionally to be the case in *P. wombat*.

Ulna and Radius.—These bones in *P. platyrrhinus* and *P. latifrons* approach closely to each other, both in the bend of the bones and in the muscular grooves and ridges.

The separation distinctive between these two species is one only of size; the ulna of the first, from the olecranon process to the styloid process, is 6", the same measured in the second is 5".5. The Common Wombat has this bone 5".8 long, but not at all so broad and strong as in them, neither has it such a deep exterior muscular groove, and its sigmoid notch is also relatively smaller in size.

As to the radius, its length bears an analogous proportion to the other bones of the fore limb—in *P. platyrrhinus* 4".4, in *P. latifrons* 4".1, and in *P. wombat* 4".2. In the last the shaft is not so strong

* Owen, Trans. Zool. Soc. vol. ii. p. 401.

and thick, and presents a lesser curve, the interosseous interspace being in consequence narrower; the two former, moreover, have a considerable forward bend in the shaft, which must admit of greater strength in the bones, and also give increased power to the muscles.

Metacarpal Bones.—Of the bones of the fore paw *P. platyrhinus* agrees with *P. wombat* in that the metacarpals are somewhat longer as compared with the digits than is the case in *P. latifrons*.

Bones of the Hind Limb.

The Pelvis.—The sacral portion of this has already been referred to in connexion with the region of the spine.

In *P. platyrhinus* the entire pelvic bones correspond with the powerful build of the body, being uncommonly strong and of great breadth and length. In the general form of the ilium, ischium, and pubis *P. platyrhinus* more nearly resembles *P. wombat* than these two species do *P. latifrons*.

Between *P. platyrhinus* and *P. wombat*, besides difference in size, the former has more marked muscular ridges and depressions. The anterior spinous process of the ilium in the first sweeps well outwards and backwards, and the ischium is unusually broad and flat at its tuberosity, the inner prominent border bending more towards the transverse processes of the caudal vertebræ. The axis of the pelvic bones, taken in a line from the spine of the ilium to the ischium, is somewhat straighter in *P. wombat* than in *P. platyrhinus*. Possibly this may be due to sex more than to specific divergence.

In *P. latifrons* the very narrowed condition of the transverse processes of the sacral and caudal vertebræ give a characteristic appearance to the pelvic region as seen dorsally. The tuberosities of the ischia not only seem wider apart, but, in comparison with the size of the bones, are substantially wider than in *P. platyrhinus* or *P. wombat*. The ventral surface, corresponding with the false pelvis of human anatomy, of each ilium in *P. latifrons* is more deeply grooved; and the anterior border of the bone, more unusually prominent, points downwards, and not outwards as in the Platyrrhine and common species. The anterior spinous process has a somewhat inward and forward curve—in this manner less backwardly falciform than in the two other species. The symphysis and the arch of the pubis are narrowest in *P. latifrons*; but the rami and tuberosities of the ischia diverge outwards and upwards (backwards). Thus each ischium has a very narrow and laterally compressed tuberosity compared with that of *P. wombat* and *P. platyrhinus*, in the latter of which the enormously expanded and roughened ischial tuberosities forcibly indicate great muscular attachment and increased volume and strength in the hinder parts.

Marsupial Bones.—These are proportionally the longest in *P. latifrons*, and in breadth and thickness agree with those of *P. wombat*. *P. platyrhinus* has them relatively the broadest. In this last also there is usually a larger interspace or foramen where they arch between the symphysis and the ilio-pubic ridge.

Femur.—The femur of *P. wombat* and that of *P. platyrhinus* are